REPORT RESUMES

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APPRENTICE EDUCATION, RELATED INSTRUCTION FOR APPRENTICES.

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NORTH CAROLINA STATE BOARD OF EDUCATION, RALEIGH

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THIS PROGRAM GUIDE IS FOR ADMINISTRATOR USE IN PLANNING AND IMPLEMENTING EFFECTIVE PROGRAMS OF RELATED INSTRUCTION FOR APPRENTICES IN THE NORTH CAROLINA COMMUNITY COLLEGE SYSTEM. IT WAS DEVELOPED BY THE LABOR DEPARTMENT APPRENTICE DIRECTOR AND STAFF, VOCATIONAL-TECHNICAL INSTRUCTORS, AND PERSONNEL FROM INDUSTRY AND DESIGNED BY SUBJECT MATTER SPECIALISTS. THE OBJECTIVE OF THE RELATED INSTRUCTION PROGRAM IS TO TEACH THE APPRENTICE THAT PART OF THE TECHNICAL INFORMATION PERTAINING TO THE TRADE WHICH CAN BEST BE TAUGHT IN THE CLASSROOM. SECTION I INCLUDES GENERAL INFORMATION CONCERNING THE PURPOSES AND THE OPERATION OF APPRENTICESHIP PROGRAMS AND THE ROLES OF THE LABOR DEPARTMENT, ADVISORY COMMITTEES, AND THE LOCAL INSTITUTIONS. SECTION II CONTAINS SUGGESTED CURRICULUMS AND COURSE DESCRIPTIONS FOR RELATED INSTRUCTION FOR OCCUPATIONS IN THE AREAS OF BUILDING TRADES, METAL AND PLASTIC MANUFACTURING, GRAPHIC ARTS, SERVICE TRADES, AND PUBLIC UTILITIES. THESE COURSE DESCRIPTIONS ARE GROUPED BY TRADE FOR THE BASIC REQUIRED COURSES, REQUIRED TRADE RELATED COURSES, AND ELECTIVE COURSES. THE REQUIRED TRAINING TIME IS GIVEN FOR EACH COURSE. THE APPRENTICESHIP PROGRAMS ARE 3, 4, OR 5 YEARS IN LENGTH AND EACH CONTAINS A MINIMUM OF 144 HOURS OF RELATED INSTRUCTION PER YEAR. SECTION III CONTAINS SAMPLE FORMS, REFERENCES FOR TEXTBOOKS AND PROGRAMED LEARNING, NATIONAL STANDARDS OF MANY TRADES, AND REFERENCES TO BE USED IN SETTING UP AN APPRENTICESHIP PROGRAM. (HC)

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APPRENTICE EDUCATION

RELATED INSTRUCTION FOR APPRENTICES

STATE BOARD OF EDUCATION
NORTH CAROLINA DEPARTMENT OF COMMUNITY COLLEGES
DIVISION OF VOCATIONAL-TECHNICAL PROGRAMS
RALEIGH, NORTH CAROLINA

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U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

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APPRENTICE EDUCATION

SECTION I

Recommended Procedures and Practices Concerning Apprentice Education

Establishment, Operation, and Implementation of CLASSES FOR RELATED INSTRUCTION

Prepared By

Howard E. Hedinger
Educational Consultant

September, 1967

DEPARTMENT OF COMMUNITY COLLEGES
VOCATIONAL-TECHNICAL DIVISION
RALEIGH, NORTH CAROLINA

MEMORANDUM

TO: The ERIC Clearinghouse on Vocational and Technical Education
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980 Kinnear Road
Columbus, Ohio 43212

FROM: (Person) Roger G. Worthington (Agency) Department of Community Colleges

(Address) Education Building, Raleigh, North Carolina

DATE: December 18, 1967

RE: (Author, Title, Publisher, Date) Howard E. Hedinger, Educational Consultant

Dept. of Community Colleges, "Apprentice Education", September, 1967

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(quantity prices)

(2) Means Used to Develop Material: Labor Dept., Apprentice Director & Staff
Development Group Voc.-Tech. Group, Instructors & Personnel from Industry
Level of Group Apprentice Training and Co-op trade programs
Method of Design, Testing, and Trial Subject matter specialists; used courses in existance; experience from a number of states designing apprentice programs; combined existing trade courses with apprenticeship courses.

(3) Utilization of Material:
Appropriate School Setting Community College (Apprenticeship)
Type of Program Apprentice & Co-op (Post-secondary related subjects)
Occupational Focus Trades for all types of industry
Geographic Adaptability U.S.A. & esp. S.E.U.S.
Uses of Material Program Guides - Local Advisory Committees.
Users of Material Administrators and Instructors - advisory committees, program Planning.

(4) Requirements for Using Material:
Teacher Competency 2-years trade experience beyond the Learning Period.
Student Selection Criteria High School Graduate or equivalent

Time Allotment Programs are 3 yrs., 4 yrs., and 5 yrs. (144 hrs. minimum. of related work per year.)
Supplemental Media --
Necessary ____) (Check Which)
Desirable X)
Text Book Companies -- American Technical Soc., Delmar Publishers; Industrial Press; McGraw-Hill; Hayden Book; Goodheart-Willcox

Describe

Source (agency) See Appendix of Manual
(address)

FOREWORD

This bulletin was prepared as a guide for the administrative personnel of the institutions in the Community College System. In North Carolina the General Statutes 115A, gives the authority for the responsibility of related instruction for apprentices to the institutions in the system. It is hoped that the contents of this publication will help the personnel of the schools in arranging, promoting and developing the various related instruction programs required. The implementation of effective programs of related instruction for apprentices in our state will require the cooperation of all persons concerned in providing these educational opportunities.

May the institutions become devoted to the pursuit of excellence in related instruction for apprentices training in North Carolina.

PREFACE

This publication provides information concerning related instruction for Apprentice Education in North Carolina's system of Community Colleges.

Unskilled production jobs are rapidly becoming fewer and harder to find in this age of rapid technological advancement. In industry the monotonous repetitive hard physical jobs are being handled by automatic equipment which requires skilled mechanics to maintain. The building industry continues to grow in our expanding economy using new materials and methods. Thus, there are many new jobs in the semiskilled, skilled, and technical areas that provide opportunities for the apprentice to receive practical instruction in classes along with on-the-job training.

Section I includes general information concerning purposes, and the operation of apprenticeship programs, as well as the roles of the Labor Department, Advisory Committees, and the local institutions.

Section II contains the suggested curriculum offerings for various trades and course descriptions of the subjects.

Section III, which is the Appendix, contains formats of forms, references for textbooks and programmed learning, national standards for the many trades, and references to be used in setting up an apprenticeship program.

CONTENTS

Section I: GENERAL INFORMATION

	Page
.Objectives of Related Instruction	1
.Why and What Is Apprenticeship Education	3
.The Role of the North Carolina Department of Labor	5
.The Role of Advisory Committees	7
.The Role of the Local Institutions	8

Section II: SUGGESTED CURRICULUMS

	Code
.Building Trades	E 90
.Metal and Plastics Manufacturing	E 91
.Graphic Arts Occupations	E 92
.Service Trades	E 93
.Public Utilities	E 94

Section III: APPENDIX

	Page
.Resource References	1
.Pamphlets for Guidance of High School Students	2
.National Standards of Apprenticeship Guides	3 - 4
.Suggested Guides for Selection of Training Content	5
.References and Outlines - Manuals of Related Instruction	6
.Sample Forms Used in Apprenticeship Training	7 -15

SECTION I

GENERAL INFORMATION

PURPOSES OF APPRENTICESHIP PROGRAMS

One purpose of this bulletin is to show briefly how the North Carolina Apprenticeship System operates. However, the main objective is to present guidelines and suggested related curricula for various occupations that require at least 4,000 hours of on-the-job training to learn. Private industry realizes that formal related instruction greatly strengthens the apprenticeship programs.

OBJECTIVES OF RELATED TRAINING

The major objective for related instruction for apprentices is to teach the apprentice that part of the technical related information pertaining to his trade which can best be taught in the classroom. Other objectives include the development of ability to apply technical related information, the evolvement of proper attitudes and human relations, and the adjustment to social problems encountered in the world of work.

GENERAL STATUTES OF NORTH CAROLINA

The North Carolina Apprenticeship System is administered by the Division of Apprenticeship Training under the North Carolina Department of Labor. The North Carolina Voluntary Apprenticeship Act of 1939 provides that related and supplemental instruction for apprentices shall be the responsibility of state and local boards responsible for vocational education.

Under General Statutes 115A, enacted in 1963, the institutions under the Department of Community Colleges have been given the responsibility for conducting the related training for apprentices in North Carolina.

WHY APPRENTICESHIP EDUCATION?

If a system of "learning by doing," under the guidance of "master craftsmen," has endured for over 4,000 years, the system undoubtedly contains basic qualitative factors for our contemporary society. These factors should be identified clearly and implemented properly in each community where such training is needed. On-the-job training programs are offered for apprentices from the industrial companies and businesses.

The institutions in the Community College System can help train the employed apprentice by making available necessary courses, instructors, and classrooms for supplemental related instruction. A concerted effort should be directed toward providing the related instruction by the Community College system.

North Carolina is requiring increasingly greater numbers of highly trained men and women to keep pace with our rapidly expanding economy. New demands on the abilities and experience of workers, who need wider training because of changing methods, materials and technology, call for a new look into educational methods. Apprenticeship is an excellent means for a young person to develop skills. As such, it makes a major contribution to our state's economic growth.

WHAT IS APPRENTICESHIP?

- Apprenticeship, in its simplest terms, is training for those occupations commonly known as skilled crafts or trades that require a wide and diverse range of skills and knowledge, as well as maturity and independence of judgment.
- As practiced by modern industry, apprenticeship is a business-like system in which the young worker entering industry is given thorough instruction and experience, both on and off the job, in all the practical and theoretical aspects of the work in a skilled trade.
- As the apprentice progresses in his training, he acquires new skills and masters the application of those already learned. This enables him to be productive during his entire period of apprenticeship.
- When properly supervised, the apprentice pays his way in production and becomes an increasingly valuable man as he progresses in his training and knowledge. Thus apprenticeship is a sound investment.

HOW APPRENTICES ARE TRAINED

- On-the-job in their trades
- For a specific length of time (continuous employment)
- At pre-determined rates of training pay (guaranteed living wage)
- For specific range of skills
- In one particular occupation such as carpentry
- With stated hours of related technical instruction
- Under a written agreement between trainer and trainee

HOW THE NATIONAL AND STATE APPRENTICESHIP GROUPS OPERATE

- Since the employment and training takes place in the local community, the work of national and state apprenticeship groups is directed toward stimulating interest in training on the part of local employers and employees.

WHAT APPRENTICESHIP CAN DO

Well-planned, properly supervised apprenticeship can do these important things:

WHAT APPRENTICESHIP CAN DO (Con't)

- Provide an efficient way to train all-round craftsmen to meet present and future needs.
- Assure an adequate supply of skilled tradesmen, in relation to employment opportunities.
- Assure the community of competent craftsmen, skilled in all branches of their trades.
- Assure the consuming public of those quality products and services that only trained hands and minds can produce.
- Increase the individual worker's productivity.
- Give the individual worker a greater sense of security.
- Improve employer-employee relations.
- Eliminate close supervision because the craftsman is trained to use initiative, imagination and ability in planning and performing his work.
- Provide a source of future supervision.
- Provide the versatility necessary to meet changing conditions.
- Attract capable young men to the industry.
- Generally raise skill levels in the industry.

For the young worker entering employment, apprenticeship holds these important values:

- The opportunity to develop his highest skills, creating a greater demand for his services throughout industry, and assuring him of greater economic security and a higher standard of living.
- Further training and education - with pay.
- Assurance of a wage while he is serving his apprenticeship, with regular increases.
- Opportunities for employment and advancement.
- Recognition as a skilled craftsman in his chosen trade.

WHO OPERATES THE APPRENTICESHIP PROGRAM?

- The American apprenticeship system is based on voluntary cooperation among management, labor, industry, government, business, and the school.
- This voluntary cooperation is reflected by using local advisory craft committees to work out suggestions and methods of development and improvement of apprenticeship training within their respective trades or industries.

THE ROLE OF THE NORTH CAROLINA DEPARTMENT OF LABOR

DIVISION OF APPRENTICESHIP TRAINING

"The North Carolina Apprenticeship System is designed as a working arrangement whereby a committee of employers and of employees will act in place of the old time 'master,' and thus get the standards into actual operation."[2]

- The primary purposes of the Apprenticeship Act, and the chief aims of the Apprenticeship Council are:
  - To assist in the development of better trained workers for the trades.
  - To provide orderly procedures for the indenturing and training of apprentices.
  - To provide the trainees with practical experience on-the-job.
  - To provide the related training and the theoretical knowledge associated.
- Note: "In the operation of the State Apprenticeship, the first consideration will be the welfare of the apprentice."[2]
- The North Carolina Director of Apprenticeship says, "Apprenticeship is planned, supervised on-the-job training, supplemented with related parallel instruction."

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[2] Quotations from Manual of the North Carolina Apprenticeship System: for details refer to this manual.

WHO COMPOSES THE APPRENTICESHIP COUNCIL

The Apprenticeship Act provides for the appointment of a State Apprentice Council and a Director of Apprenticeship. The composition of the council is as follows:

- The Commissioner of Labor as chairman.
- Three members representing employees.
- Three members representing employers.
- Director of Apprenticeship acts as secretary.
- Ex-officio member from vocational education acts as vice-chairman.

DIRECTOR OF APPRENTICESHIP: - APPOINTMENT AND DUTIES

- Appointed by the Commissioner of Labor.
- Confirmed by the State Apprenticeship Council by a majority vote.
- Some of the Duties and Functions of the Director -
    - Acts as secretary of the State Apprenticeship Council and of state advisory committees.
    - Coordinates the activities of the Apprenticeship Representatives assigned to the various districts and counties.
    - Conducts investigations of violations of Apprentice agreements.
    - Approves the transfer of agreements from one employer to another to benefit the Apprentice.
    - Keeps records of Apprentices (Indentured and Agreements cancelled)
    - Advises committees in establishing programs.
    - Issues Certificates of Completion to the Apprentices.

THE ROLE OF ADVISORY COMMITTEES

SELECTION AND APPOINTMENT OF ADVISORY COMMITTEES

- Advisory committees to aid in organizing related instruction classes should be established from interested people in the local community.
- Members of these committees should be selected by the local institution from nominees of local employer and employee groups and from local school personnel.
- The same committee may be used as the advisory committee to full-time day curriculum programs or vice versa.
- Each local committee shall determine its own organization and time and place of meeting.
- The local general apprenticeship advisory committee is appointed by the State Apprenticeship Council for any trade or group of trades in a city, county, or trade area.

SOME DUTIES OF A SUCCESSFUL ADVISORY COMMITTEE

- Determine the needs of the area for the specific occupational group.
- Help the school officials in the selection of instructors from capable journeymen or experienced teachers.
- Careful selection of applicants for apprenticeship is one of the most important considerations in assuring the success of a program.
    1. Check the school and work records to see if the applicant has the aptitude and ability necessary to master the craft.
    2. Observe if the applicant is truly interested and has sufficient perseverance and ambition to master the trade.
- Help to determine the quality and comprehensiveness of the on-the-job training and the related instruction.
- Help to determine if all the job processes listed are performed by journeymen.
- Furnishes the apprentices cards to list work processes and related instruction.

- Require the apprentice to turn his work record in to proper representative of the Advisory Committee at the end of each week or work period.

- Approve Apprenticeship Agreements, registration papers, and names for certificates of completion before they are submitted to the Director of Apprenticeship Training.

- Attend related instruction classes during the term and hold reviews of the apprentice's progress.

THE ROLE OF THE LOCAL INSTITUTIONS

WHO IS RESPONSIBLE FOR THE RELATED SUPPLEMENTAL INSTRUCTION?

- Apprenticeship programs are designed to combine on-the-job training and work experience with related instruction in the theoretical aspects of a trade taught by the local institution.

- The on-the-job training and work experience of the machinist apprentice, for example, is the responsibility of the employer. The local institution will make available any required supplemental related instruction in trade theory, blueprint reading, mechanical drawing, safe working practices, trade mathematics, physics, and other subjects related to the job.

- Responsibility for seeing that necessary related knowledge is provided rests with program sponsors and their advisory committees. In most instances, this instruction is given in local trade or vocational schools. In other instances, sponsors develop course materials and conduct their own related instruction programs, use supervised correspondence courses, or seek the services of consultants.

- In North Carolina, the local institution of the Community College System is responsible for the related instruction through the Extension Programs of the Vocational-Technical Division.

FACILITIES

- The classes may be held in the facilities of the Community College System, public schools, or industrial plants.

- The classrooms should be suitable for the program being conducted.

- The location should be convenient and suitable for the apprentice to attend.

- Equipment and laboratory facilities should be available for demonstrations. Also, storage space for materials and equipment donated or loaned by industry.

THE SCHOOL YEAR

- Each school year is divided into four terms of eleven weeks each.
- The Fall term, the Winter term, the Spring term and the Summer term.
- New related classes for apprentices will be made available as needed.

MINIMUM CLASS LOAD PER YEAR

- Apprentices shall take a minimum of 144 hours of classes each year at an approved school. Generally they attend four hours per week. Some programs may require six hours per week.
- Courses are 22 hours, 33 hours, 44 hours, 55 hours, and 66 hours in length. Course hours are generally multiples of 11 since the school term is 11 weeks in length.

SELECTION OF COURSES

- Selection of courses, length of courses and the number of hours of attendance per week should be agreed upon by the advisory committee and personnel from the institution.

ASSIGNMENT OF APPRENTICE IN RELATED CLASSES

- New apprentices with similar background and experiences may start at the same level.
- All apprentices may not start their related instruction at the same level because of the wide range of individual differences in educational background and experiences.
- Interviews, placement tests, and transcripts from former schools may indicate, that a student may enroll with advanced credit and another may enroll with certain deficiencies.

    1. Advanced credit will allow the apprentice to fulfill his required hours of related instruction by selecting the elective courses he feels will be of most value to him in his trade area. Credit may be given for equivalent courses taken at accrediated post-secondary institutions.
    2. Deficiencies should be erased by enrolling in preparatory courses offered by the institution or he may attend the learning laboratory using programmed materials.

REGISTRATION

- Apprentices will register for related classes at a time specified by the personnel of local institutions.
- The apprentice program Code E and course title are written on the registration card for local and state records.
- New apprentices may enroll for regular curriculum or extension classes that do not require prerequisites in any term during the year. They may attend day vocational classes, evening classes and/or learning laboratory using programmed studies for subjects that fit into their particular program.

FEES AND COST OF BOOKS

- Registration or tuition fees are not required of the apprentice.
- Apprentices that register for courses not listed on their approved programs will pay the regular tuition fees.
- Some instructional material fees may be charged for manuals, drafting paper, pencils, and other consumable materials. Reference - Policy Manual for Community Colleges - Standard Student Fees (3.0221-C)

  > Students enrolled in other extension classes supported in whole or in part from State funds shall, when such is necessary, be charged an instructional materials fee, which fee shall become State funds and be so deposited. Whether or not instructional materials are required and the fees that should be charged to balance out such costs for extension classes shall be determined by the chief administrative officers of institutions and extension units. If a fee that is uniform for such extension classes is desired, it is suggested that this be 10¢ per contact hour with a minimum of $2.00 per course. (6-2-66)

- Books, workbooks, notebooks are bought by the apprentice. The employer, in some cases, may buy the books through the school and deduct small amounts from the apprentice's pay checks to be reimbursed.
- Books and supplies are bought from the bookstore at the institution. If meeting in a facility not connected with the school, the employer through the Local Apprentice Advisory Committee may order and handle the books.
- Typing and printing of hand out material, tests and the like should be arranged with the extension office of the local institution.

ATTENDANCE

- Courses in Related Instruction for Apprentices are approximately eleven weeks long, therefore -

    1. Even one absence from so short a class term is highly undesirable.
    2. Occasional absence may be absolutely necessary.
    3. Good attendance enhances good scholarship.
    4. It is the responsibility of the student to make up missed assignments.

DROPPING A COURSE

- If it becomes necessary for an apprentice to drop a course, he should report it to the school office immediately.
- After the third absence from the course without explanation, an apprentice may be dropped.
- In either case, the employer and the advisory committee should be notified.

REPORTS TO EMPLOYER AND PERMANENT RECORDS

- If an apprentice is doing unsatisfactory work in class, the employer should be notified every four weeks or more often.
- When a course has been completed by an apprentice, the grade is filed in the school office on a permanent record.
- Permanent records will verify that the apprentice has completed certain courses. The permanent record of all courses are numbered in the vocational-trade series.
- The institution will notify the Local Advisory Committee that the apprentice has satisfactorily completed his required related course work.

ENROLLMENT REQUIREMENTS

- It is desirable to enroll a minimum of 15 to 20 apprentices in a class for related instruction.
- When there are not enough apprentices for a separate class, they

should be enrolled in elective trade-extension courses or be assigned programmed materials in the Learning Laboratory or for home study.

DISCONTINUED CLASSES

- In the event that class attendance decreases to a number that makes it unprofitable to continue as a group, the remainder of the class should be placed in other related vocational classes. The apprentice may be assigned to programmed studies in the Learning Laboratory or to study and complete programmed materials or workbooks at home.

INSTITUTIONAL POLICIES

- The Related Instruction for Apprentices should be an enjoyable and worthwhile experience. In order to fulfill this desire, we must have the cooperation of all persons involved in the program.
- In using the facilities of the institution or school, apprentices must adhere to their policies. Each apprentice should be informed of school policies upon entry into the program.

EXAMINATION SCHEDULES

- Examinations may be held at the end of each school quarter or when the designated class has completed the required hours.
- Examinations for programmed materials or home study work are scheduled for those students that have been assigned programmed materials for home study or the Learning Laboratory. They should be held at the end of each quarter at a time convenient to all concerned.

REPORTS REQUIRED

- Record of attendance.
- Record of achievement.
- Monthly reports of unsatisfactory work.

CERTIFICATES

- Certificates of completion of a particular class may be issued.

- Certificate of Completion of required related instruction and 8,000 hours of on-the-job work issued by the Apprenticeship Council, Director of Apprenticeship Training, Secretary.

QUALIFICATIONS AND SELECTION OF INSTRUCTORS

- An instructor of a trade extension or any related instruction class shall have at least two years of experience beyond the accepted learning period. These experiences should be in the practices and processes of the trade or occupation for which the related instruction is to be given.
- An instructor of a semi-skilled trade or any part of a skilled trade should have the same experiences.
- The instructor should be interested in teaching and have leadership ability. He should be recognized as a capable person by both employer and employee groups.
- The instructor must be a high school graduate or the equivalency. A person applying for a position as an instructor should supply personal data concerning his education and practical experience by completing the Application Form for Teaching Positions.
- Instructors should arrange to attend teacher-training classes, when they are provided by the state or local institutions through their in-service training programs.
- Some of the qualities of a successful instructor:
    - Leadership
    - Patience
    - Technical knowledge
    - Good craftsman
    - Interested in people
    - Ability to get along with people
    - Make a good presentation
    - Organize material in a logical order

BUDGET FOR RELATED INSTRUCTION

Monies to pay instructors' salaries and furnish supplies and other costs are a part of the Extension Budget. Each institution should survey the area or community for all possible classes for related instruction in order to have sufficient funds allotted for each year. (See Policy Manual, Department of Community Colleges)

INSTRUCTORS' SALARIES

Instructors are paid on an hourly basis for the number of hours the class is in session. Basic salaries are paid from funds of the Extension Budget of the Institution. The rate of hourly salary is determined by the Chief Administrative Officers of the institutions and should be the established rate paid by Extension for similar services.

ORGANIZING RELATED INSTRUCTION PROGRAMS

- Requests of employers and employees of industrial organizations for related instructional programs or separate courses should be directed to the administrators of the local institutions of the Community College System.

- All related instruction for apprentice education is the responsibility of the Extension Department of the local Vocational-Technical Division of the area institution.

- Where apprentices have contracted with an employer in ares not convenient to attend vocational classes, the employer and advisory committee should arrange correspondence courses and/or teach the related courses at his establishment, individually or in classes.

MAIN ELEMENTS FOR A SUCCESSFUL PROGRAM

- In summary there are four main elements to a successful related instruction program for apprentices. The Advisory Committee and the institution should require and follow up on them as follows:

    1. A constructive and interesting course of instruction directly related to the trade.

    2. A competent instructor, one who will prepare interesting materials and present it on a learning level of the apprentices.

3. Qualified applicants that have the ability and aptitude to master the rudiments of the trade and have sufficient education to complete satisfactorily the required related instruction.

4. Regular attendance at classes by the apprentices. Accept few excuses and require apprentices to make up all lost time.

THE ROLE OF THE VOCATIONAL-TECHNICAL DIVISION

- The Vocational-Technical Division is interested in the implementation of the related instruction required for the apprenticeship programs. Therefore, the services of the Educational Consultants are available to help advise in the implementation of the programs.

- Personnel from the Division may assist with trade analysis, curriculum guides, outlines of instruction, textbook selection, programmed instruction, and other needed materials.

- They will assist and cooperate with local and state advisory committees representing various occupational groups.

SERVICES AVAILABLE TO LOCAL INSTITUTIONS

Many local school administrators have had little opportunity to become acquainted with apprenticeship programs. In the event that an institution needs assistance in initiating a program and selecting instructional materials for conducting the related instruction classes, please notify representatives of the state staff, Vocational-Technical Division.

CURRICULUM GUIDES AND COURSE OUTLINES

- Many curriculum guides and course outlines are available at the Vocational-Technical Division in the State offices.

  - Instruction should be based upon a course outline for the particular subject and should be flexible enough to permit changes as needs arise.

  - Related supplemental instruction should be given at the time the apprentice is ready for it and preferably when he is working on the same materials and related skills on-the-job.

- Section II of this bulletin contains suggested related courses and descriptions for some of the major apprenticeship programs offered in North Carolina.

- Additional Curriculum guides for other programs will be prepared with the aid of advisory committees and distributed as the need arises and time permits.

- Many of the State Departments of Education in the United States publish Program Guides and Course Outlines for the many apprenticeable trades.

- Refer to the list of the major publishers of materials for sale in the Appendix of this bulletin for the addresses. They sell these manuals, course outlines, and tests for a nominal price.

- Several states publish, for sale, student study guide manuals and tests that accompany them.

- In many instances it will be more economical for us to buy the manuals than publish them by our Curriculum Laboratory.

MAJOR APPRENTICESHIP PROGRAMS

For classification purposes and easy reference, the main apprenticeable occupations in North Carolina have been outlined by the major titles and subtitles as published by the Director of Apprenticeship for the First Quarter of 1967.

I. BUILDING TRADES

A. Carpentry trades
1. Carpentry
2. Cabinet maker
3. Floor covering and accoustical mechanic
4. Drywall mechanic
5. Floor layer
6. Asbestos worker
7. Glazier
8. Roofer

B. Masonry trades
1. Bricklayer
2. Stone mason
3. Cement mason
4. Latherer
5. Plasterer
6. Tile and terrazzo worker

C. Plumbing and pipefitting trades
1. Boilermaker
2. Plumber
3. Pipefitter
4. Steamfitter

D. Painting trades
1. Painter and paperhanger
2. Painter
3. Paperhanger

E. Electrical trades
1. Electrician - general installation
2. Electrician - lineman and cable worker
3. Electrician - transformer
4. Electrician - motor builder

F. Structural iron and steel trades
1. Structural draftsman
2. Structural steel fabricator
3. Structural iron worker
4. Reinforcing iron worker
5. Ornamental iron worker

G. Sheet metal and air conditioning trades
  1. Drafting and sheet metal layout
  2. Sheet metal worker
  3. Aircraft metalsmith
  4. Refrigeration and sheetmetal worker

H. Construction equipment
  1. Operator
  2. Maintenance and serviceman

II. METAL AND PLASTICS TRADES

A. Machining trades
  1. Mechanical draftsman
  2. Machinist
  3. Tool & die maker

B. Manufacturing trades
  1. Maintenance mechanic (factory & mill)
  2. Non-ferrous metals
  3. Plastic trades

III. PRINTING TRADES

A. Compositor printer

B. Job printer

C. Plate maker

D. Cylinder pressman

E. Offset pressman

IV. SERVICE TRADES (MECHANICS & REPAIRMEN)

A. Passenger automobiles
  1. Automotive mechanics (general)
  2. Front-end and chassis mechanic
  3. Gas engine mechanic
  4. Brake repairman
  5. Automotive machinist

B. Automotive body repairman

C. Heavy equipment
  1. Diesel mechanic
  2. Fuel injection serviceman
  3. Bus and truck mechanic
  4. Construction equipment mechanic
  5. Tractor and farm

6. Aircraft engine mechanic
7. Aircraft mechanic
8. Aircraft sheetmetal worker

D. Air conditioning and refrigeration
   1. Air conditioning installation and maintenance
   2. Refrigeration installation maintenance

E. Electrical and mechanical
   1. Electrical appliances servicemen
      a. Small electrical appliances
      b. Larger electrical appliances (refrigerator & washer or dryer)
      c. Radio and T. V. repairman
   2. Electric motor repairman
   3. Office machines serviceman
   4. Sewing machine mechanics
      a. Industrial
      b. Domestic
   5. Knitting machine mechanics
      a. Knitting machine fixer
      b. Knitting machine mechanic

F. Other service trades
   1. Butcher - meat cutter
   2. Upholsterer - Furniture
   3. Office machine repairman

V. PUBLIC UTILITIES

A. Lineman
   1. Light and power
   2. Telephone & telegraph

B. Cable splicer & repairman

C. Telephone installer & repairman

D. Gas and water pipefitters

E. Water plant (general maintenance)

DISCRIMINATION PROHIBITED - Title VI of the Civil Rights Act of 1964 states: "No person in the United States shall, on the ground of race, color or national origin, be excluded from participation in, be denied the benefits of, or be subject to discrimination under any program or activity receiving Federal financial assistance." Therefore the Vocational Education program, like every program activity receiving financial assistance from the Department of Health, Education, and Welfare, must be operated in compliance with this law.

APPRENTICE EDUCATION

SECTION II

SUGGESTED RELATED INSTRUCTION

PROGRAM GUIDES

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DEPARTMENT OF COMMUNITY COLLEGES
VOCATIONAL-TECHNICAL DIVISION
RALEIGH, NORTH CAROLINA

SECTION II

SUGGESTED RELATED INSTRUCTION PROGRAM

° The Division of Vocational-Technical Education of the Department of Community Colleges, cooperating with the North Carolina Division of Apprenticeship Training of the Department of Labor offers the following suggested outlines of related instruction for the main programs operating in the state.

° The related instruction outlines for apprentices suggested in this bulletin represent many years of experience by teachers and administrators that have worked in North Carolina and other states. We believe that if these suggested outlines are followed, it will offer a new approach to presenting the apprentice with the needed technical information for his particular program and experiences.

° The methods of instruction for a particular program will be the decision of your local committee representing the employer, the journeymen, and the institution. Several methods are suggested as follows: The ELECTRICAL CONSTRUCTION PROGRAM has offered the integrated approach with most of the related materials being taught by one instructor. The individual classes as outlined in this bulletin may use a number of instructors that are specialists in their subject. Certain subjects can be studied in the Learning Laboratory or by using programmed materials in a classroom or at home. Individuals progress at different rates of speed; therefore, if methods and materials can be used to help the apprentice obtain the needed related courses for this trade in a minimum time period, it will be of benefit to all concerned.

° Instructors, administrators and local advisory committees who are directly in contact with apprentice education are expected to use these outlines as a basic guide for the various programs. However, in many instances, local conditions and local needs will require a modification of the outlines. Therefore, the local advisory committee meeting with a representative of the institution and the instructor and/or instructors should present the proposed curriculum before the program starts. If changes need to be made in a program which is in progress and is indentured with the Division of Apprenticeship Training; minor modifications of the outlines may be made at the discretion of the extension director and the instructors and/or with recommendations from the local advisory committee. On the other hand wherever modifications of the Related Instruction Programs, in the light of local and state needs, are major in nature, the proposed outline incorporating the changes and plans for implementation should be submitted to the Director of Apprenticeship Training for approval. This should be done in advance of the beginning of classes that will be affected by the changes.

RELATED COURSES

The related instruction for the apprentice education has been arranged into three general categories as follows:

1. REQUIRED BASIC COURSES such as reading improvement, communication skills, shop mathematics, print reading and drawing, elementary applied science, human relations and industrial safety.

2. REQUIRED RELATED COURSES which are designed to directly support the on-the-job training.

3. ELECTIVE COURSES which are offered for enrollees with advanced credit. Apprentices with advanced academic credit should attend classes for the minimum of 144 hours per year. Some of these courses may be chosen as a part of a regular program by the committee. Also other courses may be added to this list.

LENGTH OF PROGRAMS AND STUDENT LOAD

1. The related programs provided are for an indentured apprenticeship period of four years unless otherwise noted under the title of the program.

2. The apprentice should complete at least one major course and two supporting courses each year to provide a balanced program of at least 144 hours of related work.

NUMBERING OF APPRENTICE COURSES

1. REQUIRED BASIC COURSES carry the same numbers and use the same outlines as the Vocational Trade Programs.

2. REQUIRED RELATED COURSES for apprentices are identified by adding the prefix "A" to the Vocational Trade number. The classwork part of the suggested outlines prepared for the regular curriculum courses may be used as a basis of this instruction. Example: A-CAR 1101 Carpentry: Basic

3. ELECTIVE COURSES are numbered in the same manner as the basic courses and the applied courses.

TWO CODE NUMBERS LISTED ON EACH PROGRAM

1. The numbers that precede the titles on the contents sheet are instructional codes issued by the U. S. Office of Education for reporting compiled data at the end of each year. This is called National Code of Educational Statistics and is abbreviated OE-NCES.

2. The numbers listed following the titles on the contents sheet are assigned by the Director of Statistics and should be placed on the Extension Data Card at enrollment. Example: ELECTRICIAN--Commercial and Industrial E 90 E-1.

3. The suggested program guides will have the OE-NCES code number printed under the title. Also, the numbers assigned by the Director of Statistics for the Community College System are printed in the lower left hand corner of each sheet.

SUGGESTED PROGRAM GUIDES

OE-NCES		Program Codes
17.0000	Trades and Industry	
17.1000	Building Trades or Construction	E 90
	1001 Carpentry Trades	E 90 A-1
	3601 Cabinet Making	E 90 A-2
	1002 Electricity--Basic for Trades*	E 90 A-3
	1003 Construction Equipment	E 90 A-4
	1003-1 Mechanics*	E 90 A-5
	1003-2 Operator	E 90 A-6
	1004 Masonry Trades	E 90 B
	1004-1 Bricklayer	E 90 B-1
	1004-2 Cement Mason	E 90 B-2
	1005 Painting and Decorating	E 90 C
	1006 Plastering*	E 90 D-1
	1007 Plumbing and Pipefitting	E 90 D-2
17.1400	Electrical Occupations	E 90 E
	1401 Electrician--Residential, Industrial, and Commercial	E 90 E-1
	1402 Electrician Lineman and Cable Splicer	E 90 E-2
	1403 Electrician Motor Repairman*	E 90 E-3
	1404 Electrician Industrial Instruments*	E 90 E-4
17.1500	Electronics Occupations*	E 90 E
	1501 Communications	E 90 E-5
	1502 Industrial Electronics	E 90 E-6
	1503 Radio/Television	E 90 E-7
	1599 Other Electronic Occupations	E 90 E-8
17.0100	Air Conditioning	E 90 F
	0101 Cooling*	E 90 F-1
	0102 Heating*	E 90 F-2
	0103 Ventilating (Filtering & Humidification)*	E 90 F-3
	0104 Systems Installation*	E 90 F-4
	0199 Systems Maintenance	E 90 F-5
17.3000	Refrigeration*	E 90 F-6

* These programs will be developed as needed.

PROGRAM GUIDES (Con't)

OE-NCES			Program Codes
17.2300	Metalworking Occupations		E 91
	2301	Foundry*	E 91 A
	2303-1	Machinist	E 91 A-1
	2303-2	Tool & Die Maker	E 91 A-2
	2303	Machine Tool Operator*	E 91 A-3
	2304	General Metal Trades (Combined)*	E 91 B
	2305	Sheet Metal	E 91 B-1
	2306	Welding	E 91 C
	2399	Structural Steel*	E 91 C-1
17.1300	Drafting Occupations (Metalwork)		E 91 D
	1300-1	Mechanical Drafting	E 91 D-1
	1300-2	Sheet Metal Drafting	E 91 D-2
	1300-3	Structural Drafting*	E 91 D-3
17.1900	Graphic Arts Occupations*		E 92
	1901		E 92 A
	1902		E 92 B
	1903		E 92 C
	1904		E 92 D
	1905		E 92 E
17.0000	Service Trades (Mechanics & Repairman)		E 93
	0301	Automotive Body Repairman	E 93 A
	0302	Automotive Mechanics	E 93 B
	1200	Diesel Mechanic*	E 93 B-1
17.0200	Appliance Repair*		E 93 D-1
17.0500	Sewing Machine Mechanic*		E 93 D-3
17.0600	Business Machine Maintenance *		E 93 D-2
01.0300	Agricultural Mechanics		E 93 C
	0301	Farm Machinery	E 93 C-1

* These Programs will be developed as needed.

PROGRAM GUIDES (Con't)

OE-NCES			Program Codes
17.2700	Plastics Occupations*		E 93 E
17.2900	Quantity Food Occupations		E 93 F
	2901	Baker*	E 93 F-1
	2902	Cook/Chef*	E 93 F-2
	2903	Meat Cutter*	E 93 F-3
	Public Utilities		E 94
	1099	Maintenance Trades	E 94 A
		1099-1 Building Mechanic*	E 94 A-2
		1099-2 Electromechanical Mechanic*	E 94 A-3
	1007-1	Pipefitters (Gas & Water) See 1007	E 94 A-4
	1402	Lineman & Cable Splicer	E 94 A-4
17.3200	Stationary Energy Sources*		E 94 B
	3201	Electric Power & Generating Plants	E 94 B-1
	3202	Pumping Plants	E 94 B-2
	3299	Other Sanitary Sources	E 94 B-3
17.3400	Shoe Manufacturing/Repair*		
17.3500	Upholstering*		
17.3600	Woodworking Occupations*		

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* These programs will be developed as needed.

COMMUNICATION SKILLS

BASIC COURSES APPLIED TO ALL PROGRAMS

COURSE DESCRIPTIONS

No.	Title	Hours
ENG 1101	Reading Improvement	22

Designed to improve the student's ability to read rapidly and accurately. Special machines are used for class drill to broaden the span of recognition, to increase eye coordination and word group recognition and to train for comprehension in larger units.
Prerequisite: None.

No.	Title	Hours
ENG 1102	Communication Skills	33

Designed to promote effective communication through correct language usage in speaking and writing.
Prerequisite: ENG 1101.

No.	Title	Hours
ENG 1103	Report Writing	22

Fundamentals of correct language usage applied to report writing. Emphasis is on principles of report construction and application to various report forms.
Prerequisite: ENG 1102.

NOTE: This list of COURSE DESCRIPTIONS for BASIC COURSES should be issued with each PROGRAM GUIDE when requested.

COURSE DESCRIPTIONS

No. Title Hours

MAT 1101 Fundamentals of Mathematics 55

Practical number theory. Analysis of basic operations: addition, subtraction, multiplication, and division. Fractions, decimals, powers and roots, percentages, ratio and proportion. Plane and solid geometric figures used in industry; measurement of surfaces and volumes. Introduction to algebra used in trades. Practice in depth.
Prerequisite: None.

MAT 1102 Algebra 55

Basic concepts and operations of algebra: historical background of our base-10 number system; algebraic operations: addition, subtraction, multiplication and division; fractions, letter representation, grouping, factoring, ratio and proportions, variation; graphical and algebraic solution of first degree equations; solution of simultaneous equations by: addition and subtraction, substitution, graphing; exponents, logarithms, tables and interpolation.
Prerequisite: None.

MAT 1103 Geometry 33

Fundamental properties and definitions; plane and solid geometric figures, selected general theorems, geometric construction of lines, angles and plane figures. Dihedral angles, areas of plane figures, volumes of solids. Geometric principles are applied to shop operations.
Prerequisite: None.

MAT 1104 Trigonometry 33

Trigonometric ratios; solving problems with right triangles, using tables, and interpolating; solution of oblique triangles using law of sines and law of cosines; graphs of the trigonometric functions; inverse functions, trigonometric equations. All topics are applied to practical problems.
Prerequisites: MAT 1102, MAT 1103.

COURSE DESCRIPTIONS

No. Title Hours

PHY 1101 Applied Science I 33

An introduction to physical principles and their application in industry. Topics in this course include measurement; properties of solids, liquids, and gases; basic electrical principles.
Prerequisite: None.

PHY 1102 Applied Science II 33

The second in a series of two courses of applied physical principles. Topics introduced in this course are heat and thermometry, and principles of force, motion, work, energy, and power.
Prerequisite: PHY 1101.

PHY 1122 Rigging 33

A study of the methods of safe transfer of loads, breaking strength of ropes, cables and chains, knot tying and splicing will be covered whether in construction or industrial work. Slings, scaffolds, ladders, cranes, jacks, and other methods of hoisting and supporting weights will be given detailed treatment with emphasis on their safe and efficient management.

NOTE: The Applied Science courses for apprentices may follow the previous outlines used in trade courses and offer the instruction for four short courses rather than two.

COURSE DESCRIPTIONS

No. Title Hours

PSY 1101 Human Relations 33

A study of basic principles of human behavior. The problems of the individual are studied in relation to society, group membership, and relationships within the work situation.
Prerequisite: None.

BUS 1103 Small Business Operations 33

An introduction to the business world, problems of small business operation, basic business law, business forms and records, financial problems, ordering and inventorying, layout of equipment and offices, methods of improving business, and employer-employee relations.
Prerequisite: None.

BUS 1105 Industrial Organizations 33

Methods, techniques, and practices of modern management in planning, organizing and controlling operations of a manufacturing concern. Introduction to the competetive system and the factors constituting product cost.
Prerequisite: None.

ISC 1001 Industrial Safety 33

A study of the overall picture of the accident toll for the nation's population. It is designed to establish safe work habits in performing the occupation. Principles of accident prevention; injury sources and causes; accident costs; job safety analysis; accident investigation; methods of promoting safe practice, safety education and training; first aid; lifting-manually and mechanically; and fire prevention and protection are some of the topics discussed.
Prerequisite: None.

CARPENTRY
OE-NCES 17.1001

INTRODUCTION

Purpose of Program

Carpentry is one of the basic trades in the construction field. Carpenters construct, erect, install, and repair structures of wood, plywood, and wallboard, using hand and powertools. The work must conform to local building codes for both residential and commercial structures.

This curriculum in carpentry is designed to train the individual to become a craftsman in the trade with a background in both on-the-job skills and related information. He must have a knowledge of mathematics, blueprint reading, methods of construction, safety, and a thorough knowledge of building materials. Basic courses are provided to assist the apprentice to develop understandings and confidence in his relations with other persons.

The modern carpenter will work on new construction, maintenance, and repair of many types of structures, both residential and commercial. He should have an understanding of building materials, concrete form construction, rough framing, roof and stair construction, the application of interior and exterior trim, and the installation of cabinets and fixtures.

Most carpenters are employed by contractors in the building construction fields. When specializing in a particular phase of carpentry, the job is designated according to the specialty as layout carpenter, framing carpenter, concrete form carpenter, scaffolding carpenter, accoustical and insulating carpenter, and finish carpenter.

Job Description

The carpenter constructs, erects, installs and repairs structures and fixtures of wood, plywood, wall board and other materials, using carpenters handtools and powertools to conform to local building codes. He is required to use blueprints, sketches or building plans for information pertaining to type of material, dimensions, layout and design of structure, and method of construction.

BUILDING TRADES

CARPENTRY PROGRAM
(Cabinetmaking Option)

REQUIRED BASIC COURSES

No.	Title	Hours
ENG 1101	Reading Improvement	22
ENG 1102	Communication Skills	33
ISC 1001	Industrial Safety	33
PSY 1101	Human Relations	33
BUS 1103	Small Business Operations	33
MAT 1101	Fundamentals of Math	33
MAT 1112	Building Trades Math	33
DFT 1110	Blueprint Reading: Building Trades	33
DFT 1111	Blueprint Reading and Sketching: Building Trades	33

REQUIRED RELATED COURSES (CARPENTRY)

A-CAR 1101	Carpentry: Basic	33
A-CAR 1102	Carpentry: Millwork and Cabinetmaking	33
A-CAR 1103	Carpentry: Framing	33
A-CAR 1104	Carpentry: Finishing	33
A-CAR 1113	Carpentry: Estimating	33

REQUIRED RELATED COURSES (CABINETMAKING OPTION)

A-CAB 1101	Cabinet Essentials	33
A-CAB 1102	Millwork and Cabinetmaking	33
A-CAB 1111	Woodworking Materials and Supplies	33
A-DFT 1141	Building Trades Drafting I	66
A-DFT 1142	Building Trades Drafting II	66
A-DFT 1149	Principles of Cabinet Design	22
A-DFT 1150	Cabinet Layout and Details	66

ELECTIVE COURSES

ENG 1103	Report Writing	33
PHY 1101	Applied Science I	33
PHY 1102	Applied Science II	33
PHY 1122	Rigging	33
WLD 1106	Basic Welding and Cutting	33
DFT 1144	Building Materials and Methods	33
DFT 1147	Advanced Blueprint Reading (CAR & CAB)	33
A-CAR 1105	Stair Layout and Finishing	33
A-CAR 1106	Concrete Form Construction	33
A-CAR 1107	Advanced Construction Practices	33
A-CAR 1114	Building Codes	33

BUILDING TRADES

CABINETMAKING AND CARPENTRY

COURSE DESCRIPTIONS

No.	Title	Hours
A-CAB 1101	Cabinetmaking Essentials	55

This course is intended for the student wishing to extend his knowledge of cabinetmaking by studying the use of hand tools and woodworking machines. Every student advances from stage to stage, in accordance with his ability and skill on the job. The beginner studies the fundamental operations and procedures for making joints used in cabinetmaking. As he advances in types and methods of construction, and his work with machines progresses, he applies his knowledge to the building of regular projects in the shop or on a field job. He will be required to know how to adjust, sharpen, and maintain the woodworking tools and machines used on the job.
Prerequisite: None.

A-CAB 1111	Woodworking Materials and Supplies	33

Specific assignments are made on lumber, materials, hardware, and other supplies used by the carpenter and cabinetmaker. Both domestic and imported lumber, their identification and uses, the cell structure and how it affects drying and seasoning, gluing, grading, standard sizes, and units of purchase are studied. The method of manufacture, sources of raw materials, including plastics, grading systems are discussed. Extensive use of visual aids assists the students in understanding this technical information.
Prerequisite: None.

A-CAR 1101	Carpentry: Basic	33

A brief history of carpentry and present trends of the construction industry. The course will involve operation care and safe use of carpenters' handtools and powertools in cutting, shaping and joining construction materials used by the carpenter. Major topics of study will include theoretical and practical applications involving: materials and methods of construction, building layout, preparation of site, footings and foundation wall construction including form construction and erection.
Prerequisite: None.

A-CAR 1102 Carpentry: Millwork and Cabinetmaking 55

Cabinetmaking and millwork as performed by the general carpenter for building construction. Use of shop tools and equipment will be exphasized in learning methods of construction of millwork and cabinetry. Practical applications will include measuring, layout and construction of: base and wall cabinets, built in desk, door and window frames, stairs, and interior and exterior cornice and trim. Materials and finishes will also be studied.
Prerequisites: A-CAR 1101, DFT 1110.

A-CAR 1103 Carpentry: Framing 55

Instruction is given in the principles and practices of frame construction beginning with the foundation sills and including: floor joist, subfloor, wall studs, ceiling joist, rafters, bridging, bracing, sheathing and interior wall partition. Roof construction includes the layout and construction methods of common types of roofs using standard rafter construction, truss construction, and post and beam construction. Application and selection of sheathing and roofing are included. Consideration is given to the coordination of carpentry work with installation of the mechanical equipment such as: electrical, air conditioning, heating, and plumbing.
Prerequisites: A-CAR 1101, DFT 1111.

A-CAR 1104 Carpentry: Finishing 55

Exterior and interior trim and finish carpentry will complete the general carpentry program. Included will be materials and methods used in finishing carpentry such as: exterior cornice, door and window trim; interior flooring, door and window facing, moldings, and cornice construction; installation of hardware; and installation of built-in equipment and cabinets.
equipment and cabinets.
Prerequisites: A-CAR 1103, DFT 1111.

A-CAR 1105 Stair Layout and Finishing 33

Training is given in laying out and methods of constructing common stairways. The course presents the related technical work at the time the worker is learning to layout stringers, threads, and risers on the job. A study is made of problems involving the size of wall openings, the rise and run of stairways, headroom, and the layout of exterior open stairways and interior straight and winding stairways. Finishing methods of the various types of stairways and their parts are studied.
Prerequisite: A-CAR 1102.

A-CAR 1106 Concrete Form Construction 55

It covers the basic understanding and elementary methods of concrete form construction. It presents the work terms, materials, and methods used in constructing footing, wall, pier, floor, stairway forms, and those for arched openings. The fundamental details in erecting modern fireproof and fire-resisting buildings are studied.
Prerequisite: A-CAR 1101.

A-CAR 1107 Advanced Construction Practices 55

An advanced course dealing with the layout and construction of special types of roofs of equal and unequal pitch. Practice is provided in the use of the steel square for laying out the rafter cuts. Instruction is given in the mathematics necessary to find the lengths of various types of rafters and estimating of special projects. Emphasis is upon shortcuts and simplifications of layouts. Scale models of projects are made when possible.
Prerequisite: A-CAR 1103 or Journeyman Carpenter.

A-CAR 1113 Carpentry: Estimating 33

This is a practical course in quantity "take off" from prints of jobs performed by the carpenter. Figuring the quantities of materials needed and costs of building various components and structures.
Prerequisites: DFT 1111, MAT 1112.

A-CAR 1114 Building Codes 33

A study is made of building codes and the minimum requirements for local, county, and state construction regulations. This involves safety, sanitation, mechanical equipment and materials. Also, a review will be made of the minimum property requirements of the Federal Housing Administration and the North Carolina State Code.
Prerequisite: A-CAR 1103.

MAT 1112 Building Trades Mathematics 33

Practical problems dealing with volumes, weights, ratios; mensuration; and basic estimating practices for building materials.
Prerequisite: MAT 1101.

A-DFT 1141 Building Trades Drafting 66

An introduction to architectural drafting. Further development of techniques in lettering, dimensioning, freehand sketching and instrument drawing. Drawings of construction details, using appropriate material symbols and conventions. Working drawings, including plans, elevations, sections, scale details and full-size details will be prepared from preliminary sketches.
Prerequisite: A-DFT 1122.

A-DFT 1142 Building Trades Drafting 66

Individual and group participation in the preparation of complete working drawings for a complex architectural structure. Study of drafting room organization and relationships of personnel within the architectural office.
Prerequisites: A-DFT 1141, DFT 1143, and DFT 1144.

DFT 1144 Building Materials and Methods 33

Materials used in the construction of architectural structures will be studied. Their economic values and limitations affected by locality, budget, and codes. Field trips to construction sites and study of manufacturer's specifications for materials. Standard sizes of instructural materials and modular construction techniques.
Prerequisite: None.

DFT 1147 Advanced Blueprint Reading: Carpentry Trades 33

This course is designed to help the building trades worker express himself and interpret plans on the job. It includes sketching objects using straight and curved lines. Isometric, oblique, and orthographic views and methods of dimensioning are covered. The students learn to visualize and interpret elevations, plan views, sections, and details from blueprints. They learn the relationship of blueprints and specifications as applied to the building trades.
Prerequisites: DFT 1110 & DFT 1111 or Equivalent.

A-DFT 1149 Principles of Cabinet Design 22

A study of the fundamental principles of design as they apply to cabinet construction, including vertical and horizontal space divisions, the zoning of these divisions, and their surface enrichment, as well as their contour and form. Assignments give the student practice in making proper space divisions for original work. The main objective of this course is to help the worker appreciate and execute cabinet and architectural designs with greater feeling and understanding.
Prerequisites: DFT 1111 or DFT 1147 or Equivalent Drafting Courses.

A-DFT 1150 Cabinet Layout and Detailing 66

Knowledge and practice are gained in laying out the necessary drawings needed to build cabinets, store fixtures, and stairs. Rod and steel square layouts are studied and put into practice. The student makes out bills of material and estimates the cost. Full-size detail drawings are made according to the standard practices in the area.
Prerequisite: A-DFT 1149.

DFT 1110 Blueprint Reading: Building Trades 33

Principles of interpreting blueprints and specifications common to the building trades. Development of proficiency in making three view and pictorial sketches.
Prerequisite: None.

DFT 1111 Blueprint Reading and Sketching 33

Principles of interpreting blueprints and specifications common to the building trades. Practice in reading details for grades, foundations, floor plans, elevations, walls, doors and windows, and roofs of buildings. Development of proficiency in making three view and pictorial sketches.
Prerequisite: DFT 1110.

WLD 1104 Basic Welding and Cutting 33

Welding demonstrations by the instructor and practice by students in the welding shop. Safe and correct methods of assembling and operating the welding equipment. Practice will be given for surface welding: bronze welding, silver soldering, arc and gas-arc welding methods applicable to mechanical repair work.
Prerequisite: None.

HEAVY EQUIPMENT OPERATOR
(Earth Moving--3 Yrs.)
OE-NCES 17.1003-2

INTRODUCTION

Purpose of Program

In modern construction of industrial buildings, bridges, highways, shopping centers, dams, ponds, and airfields, many types of heavy equipment are used. General adoption and widespread use of this heavy equipment has created numerous employment opportunities for operators. The development and application of earth moving machines has been an outstanding phase of our construction business, and especially in highway progress.

The purpose of this program is to prepare well-trained operators of heavy earth moving and other types of power construction equipment. There are many employment opportunities which now exist and will continue to exist for many years to come.

Students interested in the operational function of heavy equipment may choose this on-the-job training program. Also, they may choose a major speciality from the following: pull shovel, backhoe, crawler type tractor, motor grader, scraper, shovel, dragline and clamshell.

Job Description

Operates several types of power construction equipment such as hoists, derricks, cranes, shovels, crawler tractor, motor graders or scrappers to excavate and grade earth, erect structural and reinforcing steel, and pour concrete.

CONSTRUCTION EQUIPMENT OPERATOR
(Earth Moving-3 Years)

Required Basic Courses are suggested along with related instruction for the several units of equipment and methods of performing the various operations. Educational materials, such as, manuals, films, and "mock-ups" should be used in the 144 hours (minimum) per year of Related Instruction. The student or apprentice has an option of one of the two programs outlined below.

BASIC RELATED COURSES

No.	Title	Hours
ENG 1101	Reading Improvement	22
ENG 1102	Communication Skills	33
MAT 1101	Fundamentals of Mathematics	33
PSY 1101	Human Relations	33
ISC 1001	Industrial Safety	33

REQUIRED RELATED COURSES

PROGRAM #1

A. CRAWLER TRACTOR
  a) Pushing
  b) Bulldozing
  c) Ditching
  d) Sloping
  e) Loading

B. MOTOR GRADER
  a) Scarifying
  b) Sloping
  c) Ditching
  d) Mixing
  e) Finishing

C. MOTOR SCRAPER
  a) Loading
  b) Dumping
  c) Ditching
  d) High Speed

PROGRAM #2

A. DRAGLINE
  a) Ditching
  b) Sloping
  c) Casting
  d) Loading

B. BACKHOE
  a) Ditching
  b) Excavating
  c) Loading
  d) Pipe Work

C. SHOVEL
  a) Loading
  b) Leveling
  c) Pit Control

Hauling
(Both Programs)

BRICKLAYING AND MASONRY
(3 yrs.)
OE-NCES 17.1004-1

Purpose of Program

Masons are the craftsmen in the building trades that work with artificial stone, brick, concrete masonry units, stone and the like. During the past decade there has been a steady incraase in the demand for these craftsmen. As building construction continues to increase the demand for bricklayers, cement masons, and stonemasons will also increase.

This program in Masonry is designed to train the individual to become a craftsman in the trade with the knowledge and basic skills that will enable him to perform effectively. He must have a knowledge of basic mathematics, blueprint reading and masonry technology. He must know the methods used in laying out a masonry job with specific reference to rigid insulation, refractories, and masonry units specified for residential, commercial and industrial construction. Other related courses are provided to develop proper human relations and safe habits at work and home.

Most employment opportunities for masons may be found with contractors in new building construction. However, a substantial proportion of masons are self-employed or work with contractors doing repair, alteration, or modernization work.

Job Description

Most masons are employed by contractors in the building construction fields to lay brick, and blocks made of tile, concrete, glass, gypsum or terra cotta. Also, he constructs or repairs walls, partitions, arches, sewers, furnaces and other masonry structures.

After gaining experience in the various types of the masonry trade along with leadership training, it is possible for the tradesman to become a foreman, inspector and eventually a contractor.

BRICKLAYING AND MASONRY
(3 yrs.)
OE-NCES 17.1004-1

REQUIRED BASIC COURSES

No.	Title	Hours
ENG 1101	Reading Improvement	22
ENG 1102	Communication Skills	33
ISC 1001	Industrial Safety	33
PSY 1101	Human Relations	33
MAT 1101	Fundamentals of Math	55

REQUIRED RELATED COURSES

MAT 1112	Building Trades Math	33
DFT 1110	Blueprint Reading: Building Trades	33
DFT 1111	Blueprint Reading and Sketching	33
A-MAS 1120	Masonry Estimating	55
A-MAS 1121	Bricklaying I	55
A-MAS 1122	Bricklaying II	55
A-MAS 1123	Bricklaying III	55

ELECTIVE COURSES

DFT 1112	Advanced Blueprint Reading and Sketching	33
A-MAS 1104	Advanced Bricklaying	55
A-MAS 1105	Concrete Technology	55
A-MAS 1106	Masonry Materials	33
A-MAS 1107	Fireplace Construction	33
A-MAS 1108	Arches, Panels and Stonework	55
A-MAS 1109	Applied Methods of Bricklaying & Masonry	44
A-MAS 1110	Quantity Survey for Masons	33

BUILDING TRADES

COURSE DESCRIPTIONS

No.	Title	Hours
A-MAS 1104	Advanced Bricklaying	33

Instruction is given in constructing walls with various brick bonds, brick sills, quoin corners, blocked walls, details of veneering, and glass blocks. Emphasis is placed upon developing on-the-job skills in cutting brick, laying out, buttering brick, plumbing, and leveling that will conform with accepted standards in the bricklaying trade.
Prerequisite: A-MAS 1123.

A-MAS 1105	Concrete Technology	33

This is a survey course offered for the construction industry, where there is an acute shortage of qualified concrete technicians, inspectors, workers, and finishers. New developments backed by years of research have provided todays concrete user with unique, attractive and practical products. Concrete products are studied from the history, design, job mixing, finishing, reinforcement, hot and cold weather curing, and the many uses for today and tomorrow.
Prerequisite:

A-MAS 1106	Masonry Materials	33

The sources of raw masonry materials, the processes of manufacture, the characteristics of these materials, and their specific uses in building construction are studied in this course. The purpose is to enrich the background of the student interested in the practical application of materials used in the bricklaying and masonry field.
Prerequisite:

A-MAS 1107	Fireplace Construction	33

A practical course in fireplace construction with emphasis upon the application of scientific principles essential for a workable fireplace. Instruction is given in laying out and constructing both a natural and a modified fireplace. Emphasis is placed on the details of the natural fireplace, such as the hearth, firebox, smoke chamber, and face.
Prerequisite: A-MAS 1104.

A-MAS 1108 Arches, Panels, and Stonework 33

A practical course covering such common arches as the segmental, gothic, semicircular, elliptical, and jack arches; brick panels with diagonal, basket weave, herringbone, and saw tooth patterns; stonework for arches and various bonds, such as the random ashlar and coursed ashlar. Methods are given and sketches are made in laying out for arches, panels, and stonework; and the cutting and laying of brick and stone.
Prerequisite: A-MAS 1104.

A-MAS 1109 Applied Methods of Bricklaying and Masonry 44

A course in applied methods for bricklaying and masonry apprentices and journeymen. Principles and specific problems are studied and sketches are made and specifications written. Such topics as terminology and theory of fireplace construction, brick arch and brick panel construction, plain and geometric ashlar stone construction, acute and obtuse corner construction, glass block, and facing tile construction are covered.
Prerequisite: Industrial apprentice or journeyman bricklayer.

A-MAS 1110 Quantity Survey for Masons 33

This is a practical course in quantity survey for bricklayers and masons. It includes the listing of all materials used in a structure in terms of various sizes, amounts, and styles. The course follows quantity survey methods common in the local building trades.
Prerequisite: MAT 1112.

A-MAS 1121 Bricklaying I 55

Instruction is provided in the history of the bricklaying industry, raw materials, basic manufacturing processes, and terminology. The use, care, and maintenance of tools and equipment of the "trowel trades" are studied. On-the-job safety practices for the specific trades are stressed. Such topics as mixing and stringing mortar, laying brick, cutting masonry materials, bonding, joints, corner and wall construction are covered.
Prerequisite: None.

A-MAS 1122 Bricklaying II 55

This course covers the intermediate phases as applied to the practices and methods in the masonry trades. Designed to give the student practice in selecting the proper mortars, layout, and construction of various building elements such as foundations, walls, chimneys, arches, cavity walls, concrete floors and pavements. The proper use of bonds, expansion strips, wall ties and caulking methods are stressed.
Prerequisite: A-MAS 1121.

A-MAS 1123 Bricklaying III 99

Related instruction is given in the more advanced phases of the trade, such as reinforced grouted brick masonry, chimneys and fireplaces, arches, floors and pavements, glazed tile panels, decorative stone including granite, marble and sandstone, adhesive terra cotta and modular masonry construction.
Prerequisite: A-MAS 1102.

MAT 1112 Building Trades Mathematics 33

Practical problems dealing with volumes, weights, ratios, mensuration, and basic estimating practices for building materials.
Prerequisite: MAT 1101.

DFT 1110 Blueprint Reading: Building Trades 33

Principles of interpreting blueprints and specifications common to the building trades. Development of proficiency in making three view and pictorial sketches.
Prerequisite: None.

DFT 1111 Blueprint Reading and Sketching 33

Principles of interpreting blueprints and specifications common to the building trades. Practice in reading details for grades, foundations, floor plans, elevations, walls, doors and windows, and roofs of buildings. Development of proficiency in making three view and pictorial sketches.
Prerequisite: DFT 1110.

DFT 1112 Blueprint Reading and Sketching 33

Designed to develop abilities in reading complex drawings in the masonry field. Blueprints of residential and commercial buildings will be studied with emphasis on the plot plan, floor plan, basement and/or foundation plan, walls and various detailed drawings of masonry work.
Prerequisite: DFT 1111.

BUILDING TRADES APPRENTICESHIP

CEMENT MASONRY
(3 Years)
OE-ACES 17.1004-2

INTRODUCTION

Purpose of Program

The growth of the concrete construction industry, partially a result of the population boom, and the increasing use of concrete products have combined to create an acute shortage of qualified concrete technicians, inspectors, workers and finishers. The total production of portland cement in the United States has doubled in the last fifteen years. The concrete industries' outlook is one of steady growth through the decades ahead.

The development of new or improved concrete products and methods, technical service, promotion and educational effort, including safety work, are primarily designed to improve and extend the uses of portland cement and concrete. This activity brought new demands that the instruction for the beginning craftsman unfold the fundamental principles of concrete work in simple terms. As the apprentice progresses, both the on-the-job training and the related instruction becomes more technical.

The outlines of the various courses are designed to help the instructors to present the courses in the fundamentals of concrete technology more effectively. Other basic related courses such as, reading improvement, communication skills, safety, applied mathematics, print reading and human relations will help the apprentice not only to become a better craftsman, but also, to develop into a good citizen of his community.

Job Description

For the trained person, the concrete industries offer unlimited job opportunities which range from manufacture, transportation, producing and placing of concrete products, promotion of concrete construction, and research in cement and concrete technology.

Perhaps the most important personal qualification for a concrete worker is integrity. A person connected with the concrete industry must be a conscientious, hard worker to succeed as a mason.

The beginning worker generally starts as a cement mason or a worker in the manufacturing of cement. There is excellent opportunities for steady employment, advancement to supervisory positions, and establishment of new businesses.

BUILDING TRADES

CEMENT MASONRY
(3 Years)

Required Basic Courses

No.	Title	Hours
ENG 1101	Reading Improvement	22
ENG 1102	Communication Skills	33
ISC 1001	Industrial Safety	33
PSY 1101	Human Relations	33
MAT 1101	Fundamentals of Mathematics	55
MAT 1112	Building Trades Math	33
MAS 1113	Masonry Estimating	55
DFT 1110	Blueprint Reading: Building Trades	33
DFT 1111	Blueprint Reading and Sketching	33

Required Related Courses

A-MAS 1131	Cement Masonry I	55
A-MAS 1132	Cement Masonry II	55
A-MAS 1133	Cement Masonry III	55

Elective Courses

A-MAS 1105	Concrete Technology	55
A-MAS 1106	Masonry Materials	33
A-MAS 1110	Quantity Survey for Masons	33
A-MAS 1130	Concrete Estimating	33
DFT 1112	Blueprint Reading and Sketching	33

BUILDING TRADES

CEMENT MASONRY
(3 - Years)

COURSE DESCRIPTION

No. | Title | Hours

A-MAS 1130 | Concrete Estimating | 33

A specialized course in how to estimate concrete for various jobs. Prints and specifications from actual building projects should be used to calculate quantities or materials required for job batching. Estimating short cuts and small concrete calculators are used for quick checking of calculations.
Prerequisite: MAT 1131.

A-MAS 1131 | Cement Masonry I | 55

This is a course in the history of apprenticeship, history of cementing materials, Portland cement, and aggregates. Includes a study of the use of hand tools, power equipment, safety practices, and applied blueprint reading for the trade.
Prerequisite: None.

A-MAS 1132 | Cement Masonry II | 55

Related instruction is offered in the uses and properties of concrete. The course includes placing finishing concrete surfaces, slabs, paving, curb and mass concrete, architectural concrete finishes, colored concrete, bonding concrete, expansion and contraction of concrete, and curing concrete.
Prerequisite: A-MAS 1131.

A-MAS 1133 | Cement Masonry III | 55

Instruction covers application of mathematics to job problems, job layout, admixtures, pozzolanic materials, industrial relations, building codes, and blueprint reading.
Prerequisite: A-MAS 1132.

A-MAS 1103 Concrete Technology 3S

This is a survey course offered for the construction industry, where there is an acute shortage of qualified concrete technicians, inspectors, workers, and finishers. New developments backed by years of research have provided todays concrete user with unique, attractive and practical products. Concrete products are studied from the history, design, job mixing, finishing, reinforcement, hot and cold weather curing, and the many uses for today and tomorrow.
Prerequisite: None

A-MAS 1106 Masonry Materials 3S

The sources of raw masonry materials, the processes of manufacture, the characteristics of these materials, and their specific uses in building construction are studied in this course. The purpose is to enrich the background of the student interested in the practical application of materials used in the bricklaying and masonry field.
Prerequisite: None

A-MAS 1110 Quantity Survey for Masons 3S

This is a practical course in quantity survey for bricklayers and masons. It includes the listing of all materials used in a structure in terms of various sizes, amounts, and styles. The course follows quantity survey methods common in the local building trades.
Prerequisite: MAT 1112.

MAS 1113 Masonry Estimating 3S

This is a practical course in quantity "take off" from prints of the more common type jobs for bricklayers and masons. Figuring the quantities of materials needed and costs of building various components and structures.
Prerequisite: MAS 1103.

DFT 1110 Blueprint Reading: Building Trades 3S

Principles of interpreting blueprints and specifications common to the building trades. Development of proficiency in making three view and pictorial sketches.
Prerequisite: None.

DFT 1111 Blueprint Reading and Sketching 33

Principles of interpreting blueprints and specifications common to the building trades. Practice in reading details for grades, foundations, floor plans, elevations, walls, doors and windows, and roofs of buildings. Development of proficiency in making three view and pictorial sketches.
Prerequisite: DFT 1110.

DFT 1112 Blueprint Reading and Sketching 33

Designed to develop abilities in reading complex drawings in the masonry field. Blueprints of residential and commercial buildings will be studied with emphasis on the plot plan, floor plan, basement and/or foundation plan, walls and various detailed drawings of masonry work.
Prerequisite: DFT 1111.

MAT 1112 Building Trades Mathematics 33

Practical problems dealing with volumes, weights, ratios; mensuration; and basic estimating practices for building materials.
Prerequisite: MAT 1101.

BUILDING TRADES APPRENTICESHIP

PAINTING AND DECORATING
OE-NEES 17.1005

INTRODUCTION

Purpose of Program

The Bureau of Labor Statistics estimates that approximately 305,000 painter craftsmen will be in the construction industry by 1975, an increase of 20,000 above the 285,000 employment level during 1965. Approximately 95,000 job openings will be available for journeymen painters in the construction industry during 1965-75 period. Of these, 75,000 will replace journeymen losses resulting from death and retirement, and 20,000 from increased demand.

In order to prepare qualified people to enter the painting and decorating trade as skilled craftsmen, the following related instruction program has been prepared.

The main objective of this guide is to provide related technical information needed to better perform the on-the-job skills and assigned operations. Other purposes are to teach proper safety procedures and to establish acceptable work habits; to develop the correct habits and techniques in the use of tools in the application of materials; to develop initiative, judgment, and an attitude for accepting individual responsibility in working with people.

Job Description

The painting and decorating craftsman is concerned with the preparation and finishing of exterior and interior surfaces. He applies to these surfaces protective or decorative coating materials such as lacquer, paint and wall-papers. His job includes scraping, burning, or sanding surfaces; making, mixing, and matching paints and colors. He applies coats of these materials with brushes, rollers, or spray-gun, or by cutting, pasting, and hanging wallpaper.

PAINTING AND DECORATING
OE-NCES 17.1005

REQUIRED BASIC COURSES

No.	Title	Hours
ENG 1101	Reading Improvement	22
ENG 1102	Communication Skills	33
MAT 1101	Fundamentals of Math	55
PSY 1101	Human Relations	33
ISC 1001	Industrial Safety	33
BUS 1103	Small Businesses	33

REQUIRED RELATED COURSES

DFT 1110	Blueprint Reading	33
DFT 1111	Blueprint Reading & Sketching	33
PAD 1101	Painting and Decorating I	44
PAD 1102	Painting and Decorating II	44
PAD 1103	Painting and Decorating III	44
PAD 1104	Painting and Decorating IV	44
PAD 1105	Industrial Painting	33
PAD 1106	Color in Paints & Decorating Materials	22
PAD 1107	Paperhanging--Specialty Materials	22
PAD 1108	Speciality Finishes and Coatings	22
PAD 1109	Wood Finishing	33
PAD 1116	Estimating--Materials and Costs	33

ELECTIVE COURSES

PHY 1122	Rigging	33
ENG 1103	Report Writing	33
A-CAR 1114	Building Codes	33
PAD 1110	Interior Decorating	33

COURSE DESCRIPTIONS

No.	Title	Hours
PAD 1101	Painting and Decorating I	44

The apprentice should know the historical background and development of the trade; how to study and retain knowledge; health and safety rules; federal, state, and local laws governing the worker.

Information is given on the selection, preparation and application of materials such as, proper paints and wall coverings; and the basic use and care of tools of the trade. Special attention is given to the preparation of plaster, masonry and concrete surfaces.
Prerequisite: None.

PAD 1102	Painting and Decorating II	44

Instruction provides advanced study of the basic topics; trade chemistry; the art of preparing colors; methods used in applying materials; brushing; spray painting techniques; materials problems and equipment maintenance; hardwood and hardwood finishes.
Prerequisite: PAD 1101 or equivalent.

PAD 1103	Painting and Decorating III	44

Additional instruction is given for advanced students in the use of tools and materials. They are taught basic blueprint reading, drawing, and sketching along with basic design methods, architectural decorating practices and finishes along with interpretation of specifications.
Prerequisite: PAD 1102 or equivalent.

PAD 1104	Painting and Decorating IV	44

Additional instruction is given on preparation of surfaces, selection and use of hand tools, materials, and equipment for the safe and economical application of wall papers, canvas, muslin, and other fabrics. Take off quantities from prints and specifications for estimates of materials and size of areas are used to compute the labor costs. Included in the course are systems of color notation; principles of harmony; psychology of color; color design; color chemistry; and the mixing and matching of color with materials of the trade.
Prerequisite: PAD 1103 or equivalent.

PAD 1105 Industrial Painting 33

Problems encountered in industrial painting not common to residential painting are discussed and calculations made for materials, scoffolding and equipment. The maximum utilization of equipment, scoffolding, labor and materials is emphasized.
Prerequisite: PAD 1104.

PAD 1106 Color in Decorating Materials 22

Studies are made of the basic theory of color and color harmony. The student makes a color wheel to help him become familiar with the elaborate schemes for classifying colors. Systems used to identify and analyze, and measure color will be included.
Prerequisite: PAD 1101.

PAD 1107 Paperhanging--Specialty Materials 22

This course is a study of preparation of surfaces, measuring, tools and equipment used for paperhanging; adhesives and their applications, and hanging standard papers. Special instruction regarding papering around windows and doors, and the use of fine papers, fabrics, and vinyls.
Prerequisite: None.

PAD 1108 Speciality Finishes and Coatings 22

Instruction includes experiences in marbleizing, graining, texturing, glazing, antiquing, stenciling, striping and lining.
Prerequisites: PAD 1101 and PAD 1102.

PAD 1109 Wood Finishing 33

This course includes study of the types of wood and their preservation, preparation and sanding, removing finish and refinishing, bleaching, staining. The use of filler, sealer, varnish, shellac, lacquer, wax, and oil for woods are included. Techniques of rubbing, polishing, buffing and repairing wood finishes will be emphasized.
Prerequisites: PAD 1101 and PAD 1102.

PAD 1110 Interior Decorating 33

Principles of interior decorating are emphasized, with regard to paints and wall coverings, to achieve both an artistic and functional effect. Paint and wall paper should produce the effect desired by the employer with relation to furniture, draperies, and floor coverings.
Prerequisites: PAD 1101, PAD 1102, PAD 1103, and PAD 1104.

PAD 1116 Estimating--Materials and Costs 33

Problems in estimating labor and materials from situations given in the related mathematics text. Estimating of labor, materials and overhead costs from figures and measurements of jobs small and large shown on building prints.
Prerequisite: MAT 1101.

A-CAR 1114 Building Codes 33

A study is made of building codes and the minimum requirements for local, county, and state construction regulations. This involves safety, sanitation, mechanical equipment and materials. Also, a review will be made of the minimum property requirements of the Federal Housing Administration and the North Carolina State Code.
Prerequisite: CAR 1104.

PLUMBING AND PIPEFITTING
OE-NCES 17.1007
INTRODUCTION

Purpose of Program

Plumbers are the craftsmen who install pipe systems which carry water, steam, air, or other liquids or gases needed for sanitation, heating, industrial production and various other uses. During the past decade there has been a steady increase in the demand for these draftsmen. As building construction continues to increase this demand for plumbers will also increase.

This program in plumbing and pipefitting is designed to train the individual to enter this occuaption with the knowledge and basic skills that will enable him to perform effecitvely. On-the-job practices provide practical experience as well as certain theoretical information that one must know to advance and keep up-to-date with new innovations. Other courses in applied science, communication skills, safety, human relations and business operations are provided to assist the individual in occupational growth.

Opportunities for plumbers and pipefitters may be found with plumbing and pipefitting contractors in new building construction. A substantial proportion of plumbers are self-employed or work for plumbing contractors doing repair, alteration, or modernization work. Some plumbers install and maintain pipe systems for government agencies and public utilities, and some work on the construction of ships and aircraft. Pipefitters, in particular, are employed as maintenance personnel in the petroleum, chemical, and food-processing industries.

Job Description

Most plumbers are employed by contractors in the building construction fields to install pipe systems which carry water, steam, air or other liquids or gases for sanitation, heating, industrial production and various other uses. They also alter and repair existing pipe systems and install plumbing fixtures, appliances, and heating and refrigeration units.

Plumbing and pipefitting are sometimes considered to be a single trade, journeymen in this field can specialize in either one. Water, gas, and waste disposal systems are installed by plumbers. Pipefitters install both high and low pressure pipes that carry hot water, steam, and other liquids and gases, especially those in industrial and commercial buildings and defense establishments, such as missile launching and testing sites.

PLUMBING AND PIPEFITTING
OE-NCES 17.1000

REQUIRED BASIC COURSES

No.	Title	Hours
ENG 1101	Reading Improvement	22
ENG 1102	Communication Skills	33
ISC 1001	Industrial Safety	33
PSY 1101	Human Relations	33
BUS 1103	Small Business Operations	33
MAT 1101	Fundamentals of Math	55
MAT 1102	Applied Algebra	55
MAT 1114	Plumbers and Pipefitters Mathematics	33
DFT 1110	Blueprint Reading: Building Trades	33
DFT 1115	Blueprint Reading: Plumbing Trades	33
PHY 1101	Applied Science	55
PHY 1102	Applied Science	55

REQUIRED RELATED COURSES

A-PLU 1101	Plumbing and Pipefitting - Fundamentals	33
A-PLU 1102	Plumbing and Pipefitting - Screw pipe & flanges	33
A-PLU 1103	Plumbing and Pipefitting - Fixtures	33
A-PLU 1104	Plumbing and Pipefitting - Soil, Waste, and Vent Pipes	33
A-PLU 1105	Plumbing and Pipefitting - Offsets, Hangers	33
WLD 1104	Basic Welding and Cutting	33
A-PLU 1106	Plastic Pipe Welding & Fabrication	22

ELECTIVE COURSES

A-PLU 1120	Low Pressure Steam Systems	33
A-PLU 1121	High Pressure Steam Systems	33
A-PLU 1123	Hot Water and Panel Heating	33
A-PLU 1125	Industrial Piping	33
A-PLU 1126	Hydraulic Systems Piping	22
A-PLU 1130	Plumbing Code 1	22
A-PLU 1131	Plumbing Code 2	22
PHY 1122	Rigging	33
A-WLD 1169	Welding: Brazing Process & Copper Pipe Work	33

BUILDING TRADES

PLUMBING AND PIPEFITTING

COURSE DESCRIPTIONS

No.	Title	Hours
A-PLU 1101	Plumbing and Pipefitting - Fundamentals	33

A study of the specifications, applications, installations and maintenance of various kinds of pipes, fittings, valves, pumps, hand tools, and small equipment used in the pipefitting trade. Methods of threading, cutting, caulking, and sweating of the various kinds of pipe and tubing used in the trade are presented.
Prerequisite: None.

A-PLU 1102	Plumbing and Pipefitting - Screw Pipe & Flanges	33

A study of materials and installation of water distribution systems beginning with the source of supply and including the location of pipes, valves, joints in both single-story and multi-story buildings. Information is presented as set up in the North Carolina Plumbing Code relative to installation of rural and city water supply systems. Piping quantity of water required, cross connections, and the well-construction code are discussed. A study is made of the types of hot water supply and their installation.
Prerequisites: A-PLU 1101.

A-PLU 1103	Plumbing and Pipefitting - Fixtures	33

A study of code requirements, design features, and installation procedures of plumbing fixtures such as water closets, lavatories, shower baths, sinks, urinals, and drinking fountains. The proper use of traps is included. Quality workmanship and safety are stressed throughout the course.
Prerequisites: A-PLU 1102.

A-PLU 1104	Plumbing and Pipefitting - Soil, Waste, and Vent Pipes	33

A study of materials used for sewer pipe, soil pipe, vent pipe, and fittings; sewage disposal, storm drainage, and ventilation; soil waste, and vent pipe principles. It includes a study of design, installation and maintenance of grease catch basins; the quality weight, and design and use of traps; and cast iron, wrought iron, steel, copper, brass, and lead pipe and fittings.
Prerequisites: A-PLU 1101.

A-PLU 1120 Low Pressure Steam Systems 33

The student will become acquainted with types of low pressure steam boilers, and the principles of boiler operation. Boiler accessories such as connectors, fittings, and insulation are to be included. Low pressure steam systems, their layout, and component parts will be studied and installed. Equipment used in heat transmission, such as radiators, coils, and connectors will be included.
Prerequisites: A-PLU 1101.

A-PLU 1121 High Pressure Steam Systems 33

Applications of low pressure steam equipment will be continued. Principles involved in industrial applications of both low-pressure and high-pressure steam equipment. Commercial and industrial blueprints will be studied utilizing low and high pressure equipment. High pressure boilers and installations of high pressure systems will be emphasized.
Prerequisite: A-PLU 1120.

A-PLU 1123 Hot Water and Panel Heating 33

The piping and accessory equipment needed to transfer hot water to radiators, heaters, and coils, and the advantages and disadvantages of each of these units will be studied, including apparatus for radiant heating and panel heating. Methods of "sizing" equipment for various installations will be included. Practical application will be provided in installing this equipment.
Prerequisites: A-PLU 1120, or A-PLU 1102.

A-PLU 1125 Industrial Piping 33

Piping systems of boilers, turbines, and steam engines especially as they are used in steam power plants, and process piping such as is used in the chemical industries will be the major emphasis of this course.
Prerequisites: A-PLU 1103.

A-PLU 1126 Hydraulic Systems Piping 22

Plumbing applications in hydraulic systems. Hydraulic principles, circuits, control valves, actuators, pumps, fluids and various accessories that complete hydraulic systems will be studied. Installation and servicing methods of these systems will be undertaken.
Prerequisites: A-PLU 1101, or A-PLU 1102.

A-PLU 1130 Plumbing Code 1 22

A study of plumbing definitions and the rules and regulations governing quality, installation, and maintenance of materials. Consideration is given to the rules and regulations pertaining to joints and connections, traps and cleanouts, water supply and distribution, plumbing fixtures, drains and sewers, and pumps.
Prerequisites: A-PLU 1101, 1102, 1103, & 1104 or equivalent.

A-PLU 1131 Plumbing Code 2 22

A study of the rules and regulations governing quality, installation and maintenance of storage heaters, storage tanks, and appliances. Regulations governing public water supply treatment, workmanship licenses, permits and fees. Inspection and tests and standard specifications for pipe maintenance procedures. Quantity take-off of pipe and equipment from a blueprint and calculating cost of fixtures and labor for installation is a typical problem in interpreting the plumbing code.
Prerequisites: A-PLU 1120 thru A-PLU 1126 or equivalent.

DFT 1110 Blueprint Reading: Building Trades 33

Principles of interpreting blueprints and specifications common to the building trades. Development of proficiency in making three view and pictorial sketches.
Prerequisite: None.

DFT 1115 Blueprint Reading: Plumbing Trades 33

Sketching diagrams and schematics, and interpretation of blueprints applicable to the plumbing trades. Emphasis will be on plumbing plans for domestic and commercial buildings. Piping symbols, schematics, diagrams and notes will be studied in detail. Applicable building and plumbing codes will be used for reference.
Prerequisite: DFT 1110.

MAT 1114 Plumbers and Pipefitters Mathematics 33

Emphasis is placed upon the development of usable skills in the layout, measurements and computations of pipe lengths, including fitting allowances. Volumes, pressure, capacities, cylinder stretchouts, heat loss, radiator size and estimating the size of piping are subjects for various calculations.
Prerequisite: MAT 1101.

WLD 1104 Basic Welding and Cutting 33

Welding demonstrations by the instructor and practice by students in the welding shop. Safe and correct methods of assembling and operating the welding equipment. Practice will be given for surface welding; bronze welding, silver soldering, arc and gas-arc welding methods applicable to mechanical repair work.
Prerequisite: None.

A-WLD 1109 Welding: Brazing Process & Copper Pipe Work 33

This course is open to plumbers only. Instruction is offered to supplement a plumber's skill in electric arc and oxyacetylene processes including silver soldering. The course covers technical terms, torches, fluxes, metal alloys, brazing rules, practice in making brazed joints (especially copper pipe) and testing of complete work.
Prerequisite: WLD 1104; A journeyman or an advanced apprentice.

A-PLU 1105 Plumbing and Pipefitting--Offsets & Hangers 33

This course deals with soil pipe offsets by means of sixteenth and sixth bends, principles of pipe bending and bending equipment; pipe hangers, clamps, supports, and fastenings; screwed drainage fittings and their application; and the installation and use of the plumbing trap.
Prerequisite: A-PLU 1104.

A-PLU 1106 Plastic Pipe Welding & Fabrication 22

This course introduces the apprentice to plastic pipe and the equipment needed to weld it. The operation of the torch and safety precautions; the starting of plastic welds, the rod manipulation, stopping the weld and welding the pipe are discussed and demonstrated. The student should be allowed to practice and make welded plastic joints on the job.
Prerequisite: WLD 1104.

N. C. DEPARTMENT OF COMMUNITY COLLEGES
Apprenticeship Training

Related and Technical Instruction Outline
for the
ELECTRICAL TRADE
(Domestic, Commercial & Industrial)

INTRODUCTION:

This outline includes that portion of the Apprenticeship Program which is conducted in the related areas of the training. The "on-the-job" or skill development phase, which constitutes the major part of the program, is conducted by the employer in work situations. In addition, there are electrical experiments to be conducted and various components to be analyzed in the school laboratory. In some instances, certain types of trade skills are not readily learned on-the-job and should be taught in a school laboratory situation. Where this occurs, the required laboratory work may be offered in addition to the related instruction. In any program the related area of the training should be coordinated with the "shop" or "on-the-job" phase of the program. Minor variations in this schedule may be made to meet local conditions.

OBJECTIVES:

The main objectives of the instruction for electrical apprentices covered in this outline are to develop
(a) an understanding of the basic technical knowledge needed in the trade
(b) the ability to perform the basic mathematical calculations required
(c) the ability to read (electrical) blueprints and make sketches
(d) desirable attitudes towards health, safety, and human relations
(e) skills not readily learned on-the-job

TIME ALLOTMENT IN HOURS:

The following figures show the approximate minimum time allotment in hours for the various subjects covered in this outline for each year.

Related Subjects	1st Year	2nd Year	3rd Year	4th Year	Total
Basic Mathematics	20	20	20	20	80
Fundamentals of Electricity and Lab.	74	80	80	75	309
National Electrical Code	20	20	15	25	80
Blueprint Reading & Sketching	20	20	25	20	85
Orientation, Safety, etc.	10	4	4	4	22
Total	144	144	144	144	576

Recommended: Additional Lab. Experience   Comm. Skills   Human Relations

Note: Blueprint Reading should be taught in conjunction with the National Electrical Code. See the suggested Program Guide with courses set up separately.

N. C. DEPARTMENT OF COMMUNITY COLLEGES
Apprenticeship Training

NOTE: This related program has been used since 1964. Designed to be taught by one instructor. The Instructors Manual and Assignment Sheets have been furnished by the Curriculum Laboratory, Vocational-Technical Division. This program was State approved and sponsored by the Carolinas Chapter of the National Electrical Contractors Association.

		Approx. Hours
ORIENTATION AND SAFETY		22
MATHEMATICS		
Fundamental Operations-Fractions, etc.		10
Decimals and Percentage		10
Powers and Roots, Ratio and Proportion		20
Formulas and Their Applications		20
Applied Trigonometry, Wire Calculations, etc.		20
	TOTAL	80
BLUEPRINT READING AND SKETCHING		
Fundamentals and 3-View Sketching		8
Reading Domestic Plans		30
Reading Commercial & Industrial Plans		40
Using Electrical Diagrams to Take Off Quantities		7
	TOTAL	85
NATIONAL ELECTRICAL CODE (Wiring Methods-54 Topics)	TOTAL	80

FUNDAMENTALS OF ELECTRICITY
(Theory, Technical Information and Applied Mathematics)

	Approx. Hours		
Introduction To Electricity	4	Transformers	20
Ohms Law and Applications	20	Motors & Generators	20
Wire Construction & Sizes	6	Motor Controls	24
Types of Circuits & Testing	8	Alternating Currents	30
Magnets and Magnetism	6	Control Circuits	20
Power and Work	4	Electronic Controls	26
Lighting & Lamps	16	Instruments	10
Inductance & Capacity	20	Laboratory Demonstrations & Practical Applications	75
		TOTAL	309

MINIMUM TOTAL HOURS FOR COURSE 576

ELECTRICAL INSTALLATION
RESIDENTIAL, COMMERCIAL & INDUSTRIAL
OE-NCES 17.1401

INTRODUCTION

Purpose of Program

The rapid expansion of the national economy and the increasing development of new electrical products is providing a growing need for qualified people to install and maintain electrical equipment. Between 5,000 and 10,000 additional tradesmen are required each year to replace those leaving the industry. It is expected that the total requirements for electrical tradesmen will reach 700,000 by 1970. The majority of the electrical tradesmen today are trained through apprenticeship or on-the-job training programs.

This program guide will provide a training program in the basic knowledge, fundamentals, and practices involved in the electrical trades. A large portion of the total program is devoted to laboratory and on-the-job instruction which is designed to give the student practical knowledge and application experience in the fundamentals taught in class.

Job Description

The graduate apprentice of the electrical installation program will be qualified as a journeyman electrician in the construction trades. He will assist in the planning, layout, installation, check out, and maintenance of systems in residential, commercial, or industrial plants. He will have an understanding of the fundamentals of the National Electrical Code regulations as related to wiring installations, electrical circuits, and the measurements of voltage, current, power, and power factor of single and polyphase alternating circuits.

He will have a basic knowledge of motor and motor control systems; industrial electronic control systems; business procedures, organization, and safety practices; communicative skills; and the necessary background to be able to advance to positions of leadership through experience and additional training.

ELECTRICAL INSTALLATION
RESIDENTIAL, COMMERCIAL & INDUSTRIAL

OE-NCES 17.1401

REQUIRED BASIC COURSES

No.	Title	Hours
ENG 1101	Reading Improvement	22
ENG 1102	Communication Skills	33
ISC 1101	Industrial Safety	33
PSY 1101	Human Relations	33
MAT 1101*	Fundamentals of Math	55

REQUIRED RELATED COURSES

A-ELC 1151	Basic Electricity I	55
A-ELC 1152	Basic Electricity II	55
A-ELC 1153	Basic Electricity III	55
A-ELC 1154	Basic Electricity IV	55
A-ELC 1124	Residential Wiring	55
A-ELC 1125	Commercial & Industrial Wiring	55
A-ELN 1118	Industrial Electronics I	33
A-ELN 1119	Industrial Electronics II	33
MAT 1115	Electrical Math	55
DFT 1110	Blueprint Reading: Building Trades	33
DFT 1113	Blueprint Reading: Electrical	33
ELC 1155	National Electrical Code (Review)	44

ELECTIVE COURSES

PHY 1101	Applied Science	55
PHY 1102	Applied Science	55
PHY 1122	Rigging	33
MAT 1116	Electrical Math	55
BUS 1103	Small Business Operations	33

* Apprentices with advanced math credit should select another course.

ELECTRICAL INSTALLATION
RESIDENTIAL, COMMERCIAL & INDUSTRIAL

COURSE DESCRIPTION

No.	Title	Hours
A-ELC 1151	Basic Electricity I	55

A study of the electrical structure of matter and electron theory, the relationship between voltage, current, and resistance in series, parallel, and series-parallel circuits. An analysis of simple current circuits by Ohm's Law and a study of the terms of electrical energy that apply to work and power.

To acquaint the learner with conductors and insulators of electricity; wire sizes; voltage drop; types of conduit; fuse rating and current protection; safety and first aid. The apprentice is introduced to the definitions and fundamental rules covered by the National Electric Code.
Prerequisite: None.

A-ELC 1152	Basic Electricity II	55

Provides fundamental concepts in single and polyphase alternating current circuits, voltages, currents, power measurements, transformers, and motors. Instruction in the use of electrical test instruments in circuit analysis. The basic concepts of AC and DC machines; simple system controls; principles of transformers and AC motors. General installation provisions permitted by the "Code" for service entrances, over-current devices, grounding and size of conductors, and various electrical systems.
Prerequisites: A-ELC 1151, MAT 1115.

A-ELC 1153	Basic Electricity III	55

This course deals with the fundamentals of alternating current electricity. Topics concerning resistance, capacitance, and inductance are thoroughly studied and related problems are solved by mathematics. Series, parallel and power in alternating circuits are presented with related problems.

The sections of National Electric Code dealing with hazardous installations are discussed. The fundamentals of motor controls are presented.
Prerequisite: A-ELC 1152.

A-ELC 1154 Basic Electricity IV (Wiring Methods--National Electrical Code) 55

Topics on the National Electrical Code are studied in terms of wiring methods in commercial and industrial installations. Outlets, switches, switchboards, and panelboards along with various control systems and basic electronics are discussed for various installations.
Prerequisite: A-ELC 1153.

A-ELC 1124 Residential Wiring 55

Provides instruction and application in the fundamentals of blueprint reading, planning, layout, and installation of wiring in residential applications such as: services, switchboards, lighting, fusing, wire sizes, branch circuits, conduits, National Electrical Code regulations in actual building mock-ups.
Prerequisites: ELC 1113, DFT 1110.

A-ELC 1125 Commercial and Industrial Wiring 55

Layout, planning, and installation of wiring systems in commercial and industrial complexes, with emphasis upon blueprint reading and symbols, the related National Electrical Codes, and the application of the fundamentals to practical experience in wiring, conduit preparation, and installation of simple systems.
Prerequisites: A-ELN 1118, A-ELC 1124.

A-ELN 1118 Industrial Electronics I 33

Basic theory, operating characteristics, and application of vacuum tubes such as: diodes, triodes, tetrodes, pentodes, and gaseous control tubes. An introduction to amplifiers using triodes, power supplies using diodes, and other basic applications of solid state controls.
Prerequisite: A-ELC 1152.

A-ELN 1119 Industrial Electronics II 33

Basic industrial electronic systems such as: motor controls, alarm systems, heating systems and controls, magnetic amplifier controls, welding control systems using thyratron tubes, and other basic solid state systems commonly found in most industries.
Prerequisite: A-ELN 1118.

MAT 1115 Electrical Math 55

A study of fundamental concepts of algebra; basic operations of addition, subtraction, multiplication, and division; solution of first order equations, use of letters and signs, grouping, factoring, exponents, ratios, and proportions; solution of equations, algebraically and graphically; a study of logarithms and use of tables; an introduction to trigonometric functions and their application to right angles; and a study of vectors for use in alternating current.
Prerequisite: MAT 1101 or equivalent.

MAT 1116 Electrical Math 55

This course contains a wide range of practical electrical problems selected to insure mastery of the basic principles of mathematics essential to the electrical trade. These problems are corrolated with the electrical principles that are involved in this course.
Prerequisite: MAT 1101.

DFT 1110 Blueprint Reading: Building Trades 33

Principles of interpreting blueprints and trade specifications common to the building trades. Development of proficiency in making three view and pictorial sketches.
Prerequisite: None.

DFT 1113 Blueprint Reading: Electrical 33

Interpretation of schematics, diagrams and blueprints applicable to electrical installations with emphasis on electrical plans for domestic and commercial buildings. Sketching schematics, diagrams, and electrical plans for electrical installations using appropriate symbols and notes according to the applicable codes will be a part of this course.
Prerequisite: DFT 1110.

ELC 1155 National Electrical Code (Review) 44

This course is set up to supplement all the Basic Electricity Courses which included code lessons concerning laws, rules, and ordinances required for the installation of electrical materials and equipment. The National Electrical Code, state and local agencies are reviewed for various subjects. The student should be brought up to date on the latest revisions. This course should help the journeyman prepare for the state electrical contractors examination.
Prerequisite: A-ELC 1154 and A-ELC 1125.

ELECTRICAL LINEMAN

OE-NCES Code 17.1402

INTRODUCTION

Purpose of Program

Electrical power requirements have multiplied during recent years because of increased industrialization and the construction of homes and public buildings that are maintained by electrical light, heat and power. With this increase in electrical power consumption, additional facilities are required along with additional skilled manpower to install, service and maintain modern equipment.

In order to prepare qualified young men to enter the electrical trade as skilled linemen, the following related studies program has been prepared.

The objectives of this program guide is to provide technical information and skills necessary to perform the jobs and operations assigned to the lineman; to teach the proper safety procedures and to establish acceptable work habits; to develop the correct habits and techniques in the use of tools and equipment of the trade; to develop initiative, judgment, and an attitude for accepting individual responsibility in working with people.

Job Description

The lineman erects wood poles and prefabricated light-duty metal towers, cable, and related equipment to construct transmission and distribution powerlines. He may assist in attaching crossarms, insulators, lightning arresters, switches, wire conductors, and auxiliary equipment to poles preparatory to erection. Climbs erected poles or towers and installs equipment such as transformers, lines or cables and other equipment. He splices, solders and insulates conductors and related wiring to join sections of powerline and to connect electrical accessories.

ELECTRICAL LINEMAN

(3 yrs. min., 4 yrs. preferred)

REQUIRED BASIC COURSES

No.	Title	Hours
ENG 1101	Reading Improvement	22
ENG 1102	Communication Skills	33
MAT 1101	Fundamentals of Math	55
PHY 1101	Applied Science	55
PHY 1102	Applied Science	55
PSY 1101	Human Relations	33

REQUIRED RELATED COURSES

A-ELC 1131	Electrical Lineman: Theory & Application I	44
A-ELC 1132	Electrical Lineman: Theory & Application II	44
A-ELC 1133	Electrical Lineman: Theory & Application III	44
A-ELC 1134	Electrical Apparatus	44
ELC 1141	First Aid	22
ELC 1142	First Aid--Advanced	22
ELC 1143	Electrical Safety Codes	22
ELC 1144	Electrical Safety Codes	22
DFT 1120	Blueprint Reading: Maps & Sketches	22
MAT 1122	Electrical Mathematics	33

ELECTIVE COURSES

ISC 1001	Industrial Safety	33
PHY 1122	Rigging	33

ELECTRICAL LINEMAN

COURSE DESCRIPTION

COURSE TITLE HOURS

A-ELC 1131 Electrical Lineman: Theory and Application I 44

Instruction is given in elements of electricity; magnetism, static electricity, cells and batteries, the electric circuit, parallel and series circuits. The student becomes acquainted with the basic tools and materials used in this trade. Identification and use of line hardware and fittings; sorting and distribution of materials, framing poles, assembly and installation of hardware, insulators, and crossarms.
Prerequisite: None.

PHY 1101 Applied Science 55

An introduction to physical principles and their application in industry. Topics in this course include measurement; properties of solids, liquids, and gases; basic electrical principles.
Prerequisite: None.

MAT 1101 *Fundamentals of Mathematics* 55

Practical number theory. Analysis of basic operations: addition, subtraction, multiplication and division. Fractions, decimals, powers and roots, percentages, ratio and proportion. Plane and solid geometric figures used in industry; measurement of surfaces and volumes. Introduction to algebra used in trades. Practice in depth.
Prerequisite: None.

ELC 1141 First Aid 22

This is a standard American Red Cross emergency first aid course. It deals with emergency first aid and safe working practices applied to the Electrical Lineman. It is designed to qualify each student for a Red Cross First Aid Card.
Prerequisite: None.

A-ELC 1132 Electrical Lineman: Theory and Application II 44

The student receives training in pole climbing and learning the correct techniques and safe practices in manipulating tools above the ground. Installation of secondary crossarms, insulators and guys, and hanging of the distribution transformer while working on the pole. Secondary light and power transformer connections, wire splices, stringing of secondary lines, use and understanding of power standards.
Prerequisite: A-ELC 1131.

MAT 1122 Electrical Mathematics 33

This course provides practical problem material for electrical students with an introduction to algebraic formulas, plane geometry and elementary trigonometry. Emphasis is placed on applications of problems which are arranged in the natural order of dependence of one topic on the next.
Prerequisite: MAT 1101.

DFT 1120 Blueprint Reading: Maps and Sketches 22

Interpretation and reading of maps, sketches, blueprints used by the electrical lineman. Information is covered on the basic principles of lines, views, dimensioning procedures, notes, symbols basic to graphic illustrations. The student is required to prepare sketches and maps of a typical line system.
Prerequisite: None.

PHY 1102 Applied Science 55

The second in a series of two courses of applied physical principles. Topics introduced in this course are heat and thermometry, and principles of force, motion, work, energy, and power.
Prerequisite: PHY 1101.

ELC 1143 Electrical Safety Codes 22

This is a study and interpretation of the state and national safety codes for outside poles, structures and line construction.
Prerequisite: None.

A-ELC 1133 Electrical Lineman: Theory and Application III 44

Training is given in checking loads on transformers, trouble shooting, rigging methods, ropes and knots; street light practices, repairing and replacing electrical apparatus, circuits, lamps, glassware, refractors, control of street lights, trouble shooting regulations and safety practices. A study of transformers, types, construction, markings, connections, oil, insulation, cooling, loading and testing; operating orders and clearances; general information needed for string standards and tower line assemblies.
Prerequisite: A-ELC 1132.

A-ELC 1134 Electrical Apparatus 44

This course deals with the basic electrical apparatus used in the line trade. Instruction will be given in use of transformers, regulators, switches, capacitors, sectionalizers, breakers, arrestors, cutouts and fuses. Laboratory experiences with this equipment will supplement classroom theory.
Prerequisite: A-ELC 1132.

ELC 1144 Electrical Safety Codes 22

A continued study of Electrical Safety Codes for installation and repair of outside poles, structures and lines.
Prerequisite: ELC 1142.

ELC 1142 First Aid - Advanced 22

This is the advanced American Red Cross emergency first aid course. It deals with field practices of first aid for the electrical lineman. It is designed to qualify each student for the advanced Red Cross First Aid Card.
Prerequisite: ELC 1141.

AIR CONDITIONING AND REFRIGERATION MAINTENANCE
OE-NCES 17.0199
INTRODUCTION

Purpose of Program

In recent years the use of air conditioning and refrigeration equipment has increased tremendously. Practically all new building construction for business and commercial use have "all year" comfort systems. Many homes now have air conditioning and the trend is toward greater use of "all year" systems of cooling and heating. The food industry is requiring greater use of refrigeration systems in freezing, storage, and display of products. With this great upswing in the use of air conditioning and refrigeration equipment, a greater demand is made on trained personnel to install, operate, maintain and service this equipment.

This program is designed to give the students practical knowledge that will enable them to become capable servicemen in the industry. The principle objective has been to outline the required technical and related instruction to enable them to understand the basic principles involved in the construction, operation, and maintenance of equipment. Job opportunities exist with companies that specialize in air conditioning, automatic heating, sheet metal and commercial refrigeration installation and service. The serviceman is employable in areas of sales, maintenance, installation and in the growing fields of truck and trailer refrigeration.

Job Description

The air conditioning and refrigeration mechanic installs, inspects, maintains, services and repairs domestic and commercial equipment. Connects motors, compressors, temperature controls, humidity controls, and circulating fans to control panels. Tests systems, observes pressure and vacuum gauges and adjusts controls to insure proper operation.

AIR CONDITIONING AND REFRIGERATION MAINTENANCE
OE-NCES 17.0199

REQUIRED BASIC COURSES

No.	Title	Hours
ENG 1101	Reading Improvement	22
ENG 1102	Communication Skills	33
MAT 1101	Fundamentals of Math	55
ISC 1001	Industrial Safety	33
PSY 1101	Human Relations	33

REQUIRED RELATED COURSES

A-AHR 1121	Principles of Refrigeration	44
A-AHR 1122	Domestic and Commercial Refrigeration	44
A-AHR 1123	Principles of Air Conditioning	44
A-AHR 1124	Air Conditioning and Refrigeration Servicing	44
A-AHR 1126	All Year Comfort Systems	44
A-AHR 1128	Automatic Controls	44
A-MEC 1120	Duct Construction and Maintenance	33
A-ELC 1102	Applied Electricity	33
PHY 1101	Applied Science	55
DFT 1104	Blueprint Reading: Mechanical	33
DFT 1116	Blueprint Reading: Air Conditioning	33
WLD 1101	Basic Gas Welding	33

ELECTIVE COURSES

BUS 1103	Small Business Operations	33
MAT 1102	Algebra	55
A-AHR 1129	Gas and Oil Burner Assembly Installations	33
A-AHR 1130	Heating Systems	22
A-AHR 1131	Heating Equipment - Installation and Servicing	33
A-AHR 1132	Gas and Oil Burner Servicing	33
A-AHR 1133	Air Conditioning Equipment	33
PHY 1122	Rigging	33
WLD 1104	Welding and Cutting	33

AIR CONDITIONING AND REFRIGERATION MAINTENANCE

COURSE DESCRIPTIONS

No.	Title	Hours
A-AHR 1121	Principles of Refrigeration	44

An introduction to the principles of refrigeration, terminology, the use and care of tools and equipment, and the identification and the function of the component parts of a system. Other topics to be included will be the basic laws of refrigeration; characteristics and comparison of the various refrigerants; the use and construction of valves, fittings, and basic controls. Practical work includes tube bending, flaring and soldering. Standard procedures and safety measures are stressed in the use of special refrigeration service equipment and the handling of refrigerants.
Prerequisite: None.

No.	Title	Hours
A-AHR 1122	Domestic and Commercial Refrigeration	44

Domestic refrigeration servicing of conventional, hermetic, and absorption systems. Cabinet care, controls, and system maintenance in domestic refrigerators, freezers, and window air conditioning units is stressed. Commercial refrigeration servicing of display cabinets, walk-in cooler and freezer units, and mobile refrigeration systems is studied. The use of manufacturers' catalogs in sizing and matching system components and a study of controls, refrigerants, servicing methods is made. The American Standard Safety Code for Refrigeration is studied and its principles practiced.
Prerequisite: A-AHR 1121.

No.	Title	Hours
A-AHR 1123	Principles of Air Conditioning	44

Work includes the selection of various heating, cooling and ventilating systems, investigation and control of factors affecting air cleaning, movement, temperature, and humidity. Use is made of psychrometric charts in determining needs to produce optimum temperature and humidity control. Commercial air conditioning equipment is assembled and tested. Practical sizing and balancing of ductwork is performed as needed.
Prerequisite: A-AHR 1122.

A-AHR 1124 Air Conditioning and Refrigeration Servicing 44

Emphasis is placed on the installation, maintenance, and servicing of equipment used in the cleaning, changing, humidification and temperature control of air in an air conditioned space. Installation of various ducts and lines needed to connect various components is made. Shop work involves burner operation, controls, testing and adjusting of air conditioning and refrigeration equipment, and location and correction of equipment failure.
Prerequisite: A-AHR 1123.

A-AHR 1126 All Year Comfort Systems 44

Auxiliary equipment used in conjunction with refrigeration systems to provide both heating and cooling for "all year" comfort will be studied and set up in the laboratory. Included will be oil fired systems, gas fired systems, water circulating systems, and electric-resistance systems. Installation of heat pumps will be studied along with servicing techniques. Reversing valves, special types of thermostatic expansion valves, systems of de-icing coils, and electric wiring and controls are included in the study.
Prerequisites: A-AHR 1123 and A-AHR 1128.

A-AHR 1128 Automatic Controls 44

Types of automatic controls and their function in air conditioning systems. Included in the course will be electric and pneumatic controls for domestic and commercial cooling and heating; zone controls, unit heater and ventilator controls, commercial fan systems controls, commercial refrigeration controls, and radiant panel controls.
Prerequisites: A-ELC 1102 and A-AHR 1122.

A-MEC 1120 Duct Construction and Maintenance 33

Study of various duct materials including sheet steel, aluminum, and fiber glass. Safety, sheet metal hand tools, cutting and shaping machines, fasteners and fabrication practices, layout methods, and development of duct systems. The student will service various duct systems and perform on the site repairs including ducts made of fiber glass. A study is made of duct fittings, dampers and regulators, diffusers, heater and air washers, fans, insulation and ventilating hoods.
Prerequisites: DFT 1116 and A-AHR 1123.

A-ELC 1102 Applied Electricity 33

The use and care of test instruments and equipment used in servicing electrical apparatus for air conditioning and refrigeration installations. Electrical principles and procedures for trouble-shooting of the various electrical devices used in air conditioning, heating, and refrigeration equipment. Included will be transformers, various types of motors and starting devices, switches, electrical heating devices and wiring.
Prerequisite: PHY 1101

DFT 1104 Blueprint Reading: Mechanical 33

Interpretation and reading of blueprints. Information on the basic principles of the blueprint; lines, views, dimensioning procedures and notes.
Prerequisite: None.

DFT 1116 Blueprint Reading: Air Conditioning 33

A specialized course in drafting for the heating, air conditioning and refrigeration student. Emphasis will be placed on reading of blueprints that are common to the trade; blueprints of mechanical components, assembly drawings, wiring diagrams and schematics, floor plans, heating system plans including duct and equipment layout plans, and shop sketches. The student will make tracings of floor plans and layout air conditioning systems.
Prerequisite: DFT 1121 or DFT 1104.

WLD 1101 Basic Gas Welding 33

Welding demonstrations by the instructor and practice by students in the welding shop. Safe and correct methods of assembling and operating the welding equipment. Practice will be given for surface welding, bronze welding, siver soldering, and flame-cutting methods applicable to mechanical repair work.
Prerequisite: None.

A-AHR 1129 Gas and Oil Burner Assembly Installations 33

Instruction is given in installing various types of gas and oil burners in different types of heating systems. Installation directions are given for gas burners, high and low pressure oil burners, and rotary oil burners in warm air, hot water, and steam heating systems.
Prerequisite: None.

A-AHR 1130 Heating Systems 22

A study is made of the construction and operation of the various types of heating systems. Adequate time is devoted to determining the correct size of the heating plant for given spaces by calculating the heat loss of a building.
Prerequisite: A-AHR 1129.

A-AHR 1131 Heating Equipment Installation and Servicing 33

The student installs and services various types of gas and oil burners in different types of heating systems. Gas burners, high and low pressure oil burners, and rotary oil burners are installed and studied in warm air, hot water and steam heating systems. The diagnosis and correction of causes of service failures constitute the major portion of the practical work in this course. Materials used in burner installations, connections to outside and inside tanks, and local regulations regarding fuel tank installations are discussed.
Prerequisite: Apprentice courses or equivalent experience.

A-AHR 1132 Gas and Oil Burner Servicing 33

The major part of the instruction of this course consists of practical methods of troubleshooting, burner operation, controls, testing and adjusting for combustion efficiency, and the location and correction of service faults. Information concerning the operation of various types of automatic heating equipment and the diagnosis and correction of service failures in the equipment will be discussed. The course is open to servicemen, steamfitters, sheet metal men, and other interested persons.
Prerequisite: Apprentice courses or equivalent experience.

A-AHR 1133 Air Conditioning Equipment (Installation, Servicing and Troubleshooting) 33

The major part of the instruction consists of burner operation, controls, testing and adjusting of refrigeration equipment, and the location and correction of service faults. During the course, the instruction covers heat gains to a building; the effect of sunlight on walls, glass, and roofs; the psychrometic chart; the cleaning, washing, humidification and cooling of the air supply to the air conditioned space; refrigeration as applied to air conditioning; duct designs and installation; the fan and blower; and a study of equipment for residential, commercial, and industrial applications.
Prerequisite: Apprentice courses or equivalent experience.

WLD 1104 Basic Welding and Cutting 33

Welding demonstrations by the instructor and practice by students in the welding shop. Safe and correct methods of assembling and operating the welding equipment. Practice will be given for surface welding; bronze welding, silver soldering, arc and gas-arc welding methods applicable to mechanical repair work.
Prerequisite: None.

MACHINIST
OE-NCES 17.2303-1

INTRODUCTION

Purpose of Program

This program guide was prepared to meet a definite need for training of machinists. Surveys recently completed in North Carolina show that many of the exisitng industries lack time and facilities for training enough machinists to meet present and planned needs. Expanding industries already located in our State and new industries under development invariably express the need for skilled craftsmen who have the background knowledge and potential to advance.

This guide is designed to give learners the opportunity to acquire on-the-job skills and the related technical information necessary to build a profitable career in the machine shop industry in the State. It is comprised of the joint views of committees responsible for its development.

Job Description

The machinist is a skilled metal worker who shapes metal parts by using machine tools and hand tools. His training and experience enable him to plan and carry through all the operations needed in turning out a machined product and to switch readily from one kind of product to another. A machinist is able to select the proper tools and material required for each job and to plan the cutting and finishing operations in their proper order so that he can complete the finished work according to blueprint or written specifications. He makes standard shop computations relating to dimensions of work, tooling, feeds, and speeds of machining. He often uses precision measuring instruments such as micrometers and gages to measure the accuracy of his work to thousandths of an inch.

This skilled worker must be able to set up and operate most types of machine tools. The machinist also must know the composition of metals so that he can heat and quench cutting tools and parts to improve machinability. His wide knowledge enables him to turn a block of metal into an intricate, precise part.

MACHINIST

REQUIRED BASIC COURSES

No.	Title	Hours
ENG 1101	Reading Improvement	22
ENG 1102	Communication Skills	33
ISC 1101	Industrial Safety	33
PSY 1101	Human Relations	33
BUS 1103	Small Business Operations	33
MAT 1101	Fundamentals of Math	55

REQUIRED RELATED COURSES

MAT 1103	Geometry	33
MAT 1104	Trigonometry	33
MAT 1123	Machinist Mathematics	33
DFT 1104	Blueprint Reading: Mechanical	33
DFT 1105	Blueprint Reading: Mechanical	33
DFT 1106	Blueprint Reading: Mechanical	33
PHY 1101	Applied Science	55
PHY 1102	Applied Science	55
A-MEC 1115	Metallurgy - Characteristics of Metals 1	33
A-MEC 1116	Metallurgy - Characteristics of Metals 2	33
A-MEC 1126	Metallurgy - Heat Treating Practices	33
A-MEC 1101	Machine Shop Theory	33
A-MEC 1102	Machine Shop Theory	33
A-MEC 1103	Machine Shop Theory	33
A-MEC 1104	Machine Shop Theory	33

ELECTIVE COURSES

A-DFT 1121	Drafting	66
A-DFT 1122	Drafting	66
A-DFT 1131	Mechanical Drafting	66
A-DFT 1132	Mechanical Drafting	66
ELC 1101	Applied Electricity	22
BUS 1105	Industrial Organizations	33
MEC 1140	Hydraulics - Fundamentals	33
WLD 1104	Basic Welding and Cutting	33

MANUFACTURING AND MACHINING

MACHINIST

COURSE DESCRIPTIONS

No. Title Hours

A-MEC 1101 Machine Shop Theory 33

An introduction to the machinist trade and the potential it holds for craftsmen. Deals primarily with the identification, care and use of basic hand tools and precision measuring instruments. Elementary layout procedures and processes of lathe, drill press, grinding (off-hand) and milling machines will be introduced in theory only.
Prerequisite: None.

A-MEC 1102 Machine Shop Theory 33

Advanced operations in layout tools and procedures, power sawing, drill press, surface grinder, milling machine shaper. The student will study the basic operations on the cylindrical grinder and will select tools and procedures to be used.
Prerequisite: A-MEC 1101.

A-MEC 1103 Machine Shop Theory 33

Advanced work on the engine lathe, turning, boring and threading machines, grinders, milling machine and shaper. Introduction to basic indexing and terminology with additional processes on calculating, cutting and measuring of spur, helical, and worm gears and wheels. The trainee will use precision tools and measuring instruments such as vernier height gauges, protractors, comparators, etc. Basic procedures for exercises will be given for use on the turret lathe and on the tool and cutter grinder.
Prerequisite: A-MEC 1102.

A-MEC 1104 Machine Shop Theory 33

Development of class projects using previously learned procedures in planning, blueprint reading, machine operations, final assembly and inspection. Additional processes on the turret lathe, tool and cutter grinder, cylindrical and surface grinder, advanced milling machine operations, etc. Special procedures and operations, processes and equipment, observing safety procedures faithfully and establishing of good work habits and attitudes acceptable to the industry.
Prerequisite: A-MEC 1103.

A-MEC 1115 **Metallurgy - Characteristics of Metals I** 33

Investigates the properties of ferrous metals and tests to determine their uses. Instructions will include some chemical metallurgy to provide a background for the understanding of the physical changes and causes of these changes in metals. Physical metallurgy of ferrous metals, producing iron and steel, theory of alloys, shaping and forming, heat treatments for steel, surface treatments, alloy of special steel, classification of steels, and cast iron will be topics for study.
Prerequisite: None.

A-MEC 1116 **Metallurgy - Characteristics of Metals II** 33

Continuation of the study of physical metallurgy. The non-ferrous metals: bearing metals, (brass, bronze, lead), light metals (aluminum and magnesium), and copper and its alloys are studied. Powder metallurgy, titanium, zirconium, indium, vanadium, and also plastics are included in this course.
Prerequisite: MEC 1115.

A-MEC 1126 **Metallurgy - Heat Treating Practice** 33

Working knowledge of the methods of treating ferrous and nonferrous metals. The effects of hardening, tempering, and annealing upon the structure and physical properties of metals. Trainees will be given the opportunity to acquaint themselves with the equipment and processes of heat treating.
Prerequisite: MEC 1124.

MEC 1140 **Hydraulics - Fundamentals** 33

This course is arranged to give the student a general knowledge of the basic components of hydraulic systems, as well as a general understanding of the basic laws and formulas used in simple hydraulic calculations. Course covers such topics as pumps, control valves, control assemblies, actuators the use of standard hydraulic symbols and basic maintenance procedures.
Prerequisite: None.

MAT 1123 **Machinist Mathematics I** 33

Introduces gear ratio, lead screw and indexing problems with emphasis on application to the machine shop. Practical applications and problems furnish the trainee with experience in geometric propositions and trigonometric relations to shop problems; concludes with an introduction to compound angle problems.
Prerequsite: MAT 1104.

ELC 1101 Applied Electricity 44

Basic applications of electricity, types of electricity, methods of production, transmission and transforming of electrical energy. Topics presented are the fundamentals of direct and alternating currents, generators and motors, control circuits, protective devices, three phase current and voltage relationships, safety codes, installation and maintenance practices of electrical machines.

DFT 1104 Blueprint Reading: Mechanical 33

Interpretation and reading of blueprints. Information on the basic principles of the blueprint; lines, views, diminsioning procedures and notes.
Prerequisite: None.

DFT 1105 Blueprint Reading: Mechanical 33

Further practice in interpretation of blueprints as they are used in industry; study of prints supplied by industry; making plans of operations; introduction to drafting room procedures; sketching as a means of passing on ideas, information and processes.
Prerequisite: DFT 1104.

DFT 1106 Blueprint Reading: Mechanical 33

Advanced blueprint reading and sketching as related to detail and assembly drawings used in machine shops. The interpretation of drawings of complex parts and mechanisms for features of fabrication, construction and assembly.
Prerequisite: DFT 1105.

A-DFT 1121 Elementary Drafting 66

An introduction to drafting and the study of drafting practices. Instruction is given in the selection, use and care of instruments, single-stroke lettering, applied geometry, freehand sketching consisting of orthographic and pictorial drawings. Orthographic projection, reading and instrument drawing of principal views, single auxiliary views (primary), and double (oblique) auxiliary views will be emphasized. Dimensioning and note practices will be studied with reference to the American Standards Association practices. Methods of reproducing drawings will be included at the appropriate time.
Prerequisite: None

A-DFT 1122 Drafting 66

The trainee will study simple and successive revolutions and their applications to practical problems. Sections and conventions will be studied and both detail and assembly sections will be drawn. Intersections and developments will be studied by relating the drawing to the sheet metal trades. Models of the assigned drawings will be made from construction paper, cardboard, or similar materials as a proof of the solution to the problems drawn.

Methods of drawing and projecting axonometric, oblique, and perspective drawings will be studied with emphasis on the practical applications of pictorial drawings. Various methods of shading will be introduced and dimensioning and sectioning of oblique and axonometric pictorials will be done.
Prerequisite: DFT 1121.

A-DFT 1131 Mechanical Drafting 66

An introduction to mechanical drafting beginning with problems concerning precision and limit dimensioning. Methods of fastening materials, and fasteners: keys, rivets, springs, and welding. Symbols will be studied and drawings will be made involving these items. Principles of design will be introduced with the study of basic mechanisms of motion transfer; gears, cams, power trains, pulleys, belting and methods of specifying and calculating dimensions will be studied. Drawings will be made involving these mechanisms.
Prerequisite: DFT 1122.

A-DFT 1132 Mechanical Drafting 66

Principles of design sketching, design drawings, layout drafting, detailing from layout drawings, production drawings and simplified drafting practices constitute areas of study. Forging and casting drawings will be made from layouts. Specifications, parts list and bill of materials are emphasized in this course. The student will develop a complete set of working drawings of a tool, jig, fixture or simple machine and learn principles of design, handbook and manual usage.
Prerequisite: DFT 1131.

WLD 1104 Basic Welding and Cutting 33

Welding demonstrations by the instructor and practice by students in the welding shop. Safe and correct methods of assembling and operating the welding equipment. Practice will be given for surface welding; bronze welding, silver soldering, arc and gas-arc welding methods applicable to mechanical repair work.
Prerequisite: None.

ELC 1101 Basic Electricity (Applied) 22

This course covers the elementary principles of electricity, including units and terms, Ohm's Law, power, and types of electricity with specific application to the operation of electrical devices.
Prerequisite: None.

TOOL AND DIE MAKING
OE-NCES 17.2302-1

INTRODUCTION

Purpose of Curriculum

Mass production depends upon a steady flow of parts that have all been made to the same specifications. These parts may have been produced by machines which complete a repetitive cycle of operations, or they may have been produced by punching or stamping them into the required sizes and shapes. It is the responsibility of the tool and die maker to produce the special tools and fixtures for these machining operations. He may also produce the gauges and the other inspection tools used in checking machined parts. Many short-cut production methods were developed during the past two decades, and production was thus speeded up because of the special tooling, dies, jigs, and fixtures which were produced by tool and die makers. Industry is constantly using these short-cut production methods, especially since automatic machines have been introduced.

To complete this training successfully, a student should have a high school diploma or its equivalent. He should have a good knowledge of mathematics and be able to use his hands skillfully in the manipulation of tools. He should be a selected graduate from a recognized machinist program or an indentured apprentice program or present proof of equivalent work experience.

Job Description

A tool and die maker analyzes a variety of specifications, lays out metal stock, sets up and operates machine tools. He fits and assembles parts to make and repair metal working dies, cutting tools, jigs, fixtures, gauges, and machinists' handtools. He computes dimensions, decides on machining to be done, and plans layout and assembly operations.

Typical jobs which he might secure in the manufacturing field include: toolmaker, diemaker, tool repairman, tool (set-up) man, and tool inspector.

MANUFACTURING AND MACHINING

TOOL AND DIE MAKER

REQUIRED BASIC COURSES (PREREQUISITE)

To complete this training successfully, a student should have a high school diploma or its equivalent. He should have a good knowledge of mathematics and be able to use his hands skillfully in the manipulation of both hand and machine tools. He should be a selected graduate from a recognized machinist program or have equivalent work experience. In the event an applicant has not completed all the required basic courses of the Machinist Curriculum, he should enroll for these subjects. This will qualify the apprentice to continue his work and become a Tool and Die Maker journeyman.

REQUIRED RELATED INSTRUCTION

No.	Title	Hours
MAT 1105	Trigonometry-Survey & Applications	33
MAT 1106	Trigonometry-Compound Angles, etc.	33
A-MEC 1151	Tool Making-Jigs & Fixtures	44
A-MEC 1152	Tool Making-Gages & Special Tools	44
A-MEC 1153	Tool Making-Advanced	44
A-MEC 1154	Die Making I -Principles	44
A-MEC 1155	Die Making II -Methods of Design, etc.	44
A-MEC 1156	Die Making III -Progressive Dies	44
A-MEC 1158	Introduction to Plastic Molds	22
A-MEC 1159	Print Reading & Inspection	22
A-MEC 1160	Special Problems (Tool & Die)	33
A-MEC 1161	Production Practices	33
A-MEC 1157	Tool Design for Production	33

ELECTIVE COURSES

A-ELC 1125	Electricity (Industrial Machines)	22
A-MEC 1140	Hydraulics-Fundamentals	33
A-MEC 1162	Tool & Die Making (Review)	33
A-MEC 1163	Tool & Die Machine (Survey)	33
A-MEC 1170	Tool Design - Advanced	66
A-MEC 1171	Die Design and Diesinking Methods	66

MANUFACTURING AND MACHINING

TOOL AND DIE MAKER

COURSE DESCRIPTIONS

No. Title Hours

A-MEC 1151 Tool Making: Jigs & Fixtures 44

This course is designed to help the student become more proficient in working to very close tolerances. The student will learn the best methods of fastening parts together, clamping and locating methods, and the application of jigs and fixtures to production machining. Emphasis is stressed throughout on the quality of workmanship and precision tolerances.
Prerequisites: A-MEC 1104; A-DFT 1106 and DFT 1121 or Equivalent.

A-MEC 1152 Tool Making: Gages & Special Tools 44

A study of precision gages will be made. Special tools and their application to production are studied, such as making plug gages, ring gages, snap gages, etc. The student will write the procedure for making of special projects, such as, slide tools, form tools, and fly cutters.
Prerequisite: A-MEC 1151.

A-MEC 1153 Advanced Tool Making 44

A continuation of tool making practices. On-the-job project work will be planned which consist of complicated jigs and fixtures, including pneumatic operated fixtures and power clamping methods. Further instruction given in form grinding and form dressing procedures, surface finishes, precision tolerances, and general tool making practices.
Prerequisite: A-MEC 1152.

A-MEC 1154 Die Making I 44

This course is designed to introduce the student to the principles of Dies and Die Making. Simple piercing and blanking dies will be studied and the student acquainted with terminology common to the trade. Accuracy, surface finish, importance of clearances, radiuses and the press cycle will be studied. Student will build and set up for production a simple die, working from blueprints and maintaining specified accuracy.
Prerequisite: Machinist Trade Diploma or Equivalent.

A-MEC 1155 Die Making II 44

A continuation of the study of dies, the dangers of insufficient and excessive cutting clearances, and methods of providing angular clearances. Factors affecting stripping force will be discussed along with bending stresses, deformation due to bending and the bend allowance curve. Student will write a procedure to build a form and bending die. Development of correct working habits and close tolerance machining is stressed.
Prerequisite: A-MEC 1154.

A-MEC 1156 Die Making III 44

The theory and design of progressive dies will be studied. The student will be given instruction in the location of pilots, the progressive cam stages, grinding operations, and blank development. The student will machine, assemble, and set up a conventional progressive die involving three or more stages. Further theory and practice is given in plastic molds.
Prerequisite: A-MEC 1155.

A-MEC 1157 Tool Design for Production 33

This course will enable the student to plan the process of production and isolate the areas that must be tooled for production. Cost of tools, die work, jig and fixtures, and gaging will be considered. Students will review available items from vendors and utilize standard bushing charts and other references. Typical tool design procedures will be employed and prints must reflect standard procedures.
Prerequisite: Required Related T & D Courses or Equivalent.

A-MEC 1158 Introduction to Plastic Molding 22

Due to the expanding use of plastics, the need for mold making has greatly increased. This course is designed to acquaint the student with the design and construction of simple molds, differences between molds and dies, surface finishes, closures, gates and runners, and ejection methods. Methods of cooling will also be discussed and the student will build a simple mold to prescribed accuracy and finish.
Prerequisite: Required Related T & D Courses or Equivalent.

A-MEC 1161 Production Practices 44

Survey of machines and equipment used in Tool and Die production. Construction, care, and safe use of these machine tools. Types of operations performed on various machines, attachments, and holding devices. The application of handbooks to production problems; analysis of operations required; material handling, flow charts, design of tools, jigs, fixtures, etc. A written report with sketches of the production planning required of a selected product to be produced.
Prerequisite: Required Related T & D Courses or Equivalent.

A-MEC 1162 Tool & Die Making (Review) 33

This is a course in tool and die making, which is an advanced study of the machinist trade. It consists of related technical theory in the building of tool jigs and fixtures, gages, forging dies, plastic dies and die casting, and also the set up of dies for punch press operation. It solves problems involving algebra, geometry, and trigonometry fundamentals as applied to the building of the above mentioned tools and dies. Emphasis is placed on the technical knowledge and use of precision instruments such as comparators, elactrowave inspection, gage inspection, and metallurgy, etc.
Prerequisite: Required Related T & D Courses or Equivalent.

A-MEC 1163 Tool & Die Machine (Survey) 33

This course is designed to introduce the student to the tools, instruments, and machines used in the tool and die shop. The student will compare the machines used in production with those used in tool and die making. The student will become familiar with jigs and fixtures and their applications pertaining to production machining.
Prerequisite: Machinist Trade Diploma or Equivalent.

A-MEC 1140 Hydraulics - Fundamentals 33

This course is arranged to give the student a general knowledge of the basic components fo hydraulic systems, as well as a general understanding of the basic laws and formulas used in simple hydraulic calculations. Course covers such topics as the use of standard hydraulic symbols, pumps, control valves, control assemblies, actuators and basic maintenance procedures.
Prerequisite: None.

A-MEC 1159 Blueprint Reading and Inspection 22

This course is to enable the tool and die student to correctly interpret the more complicated die drawings. Methods of machining complicated parts will be discussed and lab practice for inspection of die components will be held.
Prerequisite: DFT 1106.

A-MEC 1160 Special Problems (Tool and Die) 33

This course consists of projects that present problems as to machining methods and cost. Special projects will be presented in jig boring and duplicator work, short life jigs and welding fixtures and special angle radius and circular problems; field trips, to acquaint the student more fully with needs for production tooling, will be a part of this course.
Prerequisite: All basic courses & equivalent.

MAT 1105 Trigonometry - Survey & Applications 33

A review of trigonometric functions and tables and solution of problems involving right triangles. Problem solving by resolving figures into right triangles and relationships between trigonometric functions. Solutions of oblique triangles, the sine and cosine laws, problems involving tapers, the sine bar, precision discs, taper plus gages, angles, and circular arcs.
Prerequisite: MAT 1104.

MAT 1106 Mathematics: Compound Angles, etc. 33

This course consists basically of the fundamentals of solid geometry and trigonometry of compound angles, problem solving from pictoral drawings of compound angular holes, tilting angles and angles of rotation, and problems having tool and die application.
Prerequisites: MAT 1103, MAT 1104, and MAT 1105.

ELC 1101 Basic Electricity (Applied) 22

This course covers the elementary principles of electricity, including units and terms, Ohm's Law, power, and types of electricity with specific application tc the operation of electrical devices.
Prerequisite: None.

A-ELC 1125 Electricity (Industrial Machines) 22

The fundamentals of basic electricity (direct and alternating current) are reviewed with work on the following topics: series and parallel circuits, electrical power and energy, wire sizes, magnetism, and the principles of motors, generators and transformers. Single-phase and three-phase circuits, and synchronous motor operation are discussed.
Prerequisite: ELC 1101 or PHY 1101.

A-MEC 1170 Tool Design - Advanced 66

This is a high-level study of the planning and designing of production tools. It includes the technical, production and economic considerations necessary in the design of jigs, fixtures, gages, and light dies. Actual problems for production are solved, and practical designs produced following the same principles and procedures now being used in industry.
Prerequisite: All Tool & Die courses.

A-MEC 1171 Die Design & Diesinking Methods 66

A course designed to meet the needs of tool and die makers who wish to specialize or gain additional knowledge and practice in the field of die designing. The practical work consists of designing, laying out, and drawing some of the more common types of dies, such as, pierce and blank, progressive and compound, and form and draw dies.
Prerequisite: DFT 1132 and MAT 1106.
All Tool and Die courses.

METAL WORKING OCCUPATIONS
BUILDING TRADES

APPRENTICESHIP

SHEET METAL WORKER
OE-NCES 17.2305

OPTION--SHEET METAL LAYOUT DRAFTSMAN
OE-NCES 17.1300-2

Purpose of Program

This program guide with the option has been prepared to assist in planning and developing courses for workers in the sheet metal industry. Within the next five (5) years this industry will require at least 25,000 workers for replacements not counting the many needed for expansion.

This guide is organized to present the related materials that are needed for the trainee to be given a sound foundation in layout, a knowledge of fabrication and metals, and principles of basic product design. The trainee may choose to become a Sheet Metal Layout Draftsman by taking the sheet metal drafting courses as options. Also, he may continue his apprenticeship, or education in the area of his interest which may assist in leading to positions of responsibility.

The sheet metal workers and layout draftsmen are involved in an industry that is centered around construction and manufacturing. Workers install ducts which are used in ventilating, air conditioning, tobacco processing plants, and other systems requiring movement of air. They also fabricate and install roofing, siding, flashing, venting, commercial stainless steel kitchen equipment, cabinets, partitions, store fronts, metal framework for advertising signs, and structures used for material movement and collection.

Job Description

The beginning sheet metal workers are required to be skilled in all aspects to use tools and machines of cutting, forming, bolting, riveting, cementing, punching, pressing, drilling, sawing, welding, brazing, and soldering the products. Generally, the experienced sheet metal worker, foreman or leader, plans and lays out the job and takes the responsibility to determine the size and type of metal to be used.

The beginning worker will assist in the installation of the products including several types of plastics used for air or liquid. Many experienced sheet metal workers become expert layout draftsmen and planners in the industry.

SHEET METAL WORKER

(Sheet Metal Layout Drafting-Option)
OE-NCES 17.2305
OE-NCES 17.1300-2

REQUIRED BASIC COURSES

No.	Title	Hours
ENG 1101	Reading Improvement	22
ENG 1102	Communication Skills	33
ISC 1001	Industrial Safety	33
PSY 1101	Human Relations	33
BUS 1103	Small Business Operations	33
MAT 1101	Fundamentals of Mathematics	55
MAT 1103	Geometry	33
PHY 1101	Applied Science	55
PHY 1102	Applied Science	55
A-MEC 1115	Metallurgy-Characteristics of Metals I	33
A-DFT 1121	Drafting (Elementary Projection)	66
A-DFT 1116	Blueprint Reading - Air Conditioning	44

REQUIRED RELATED COURSES

A-MEC 1141	Sheet Metal I	44
A-MEC 1142	Sheet Metal II	44
A-MEC 1143	Sheet Metal III	44
A-MEC 1144	Sheet Metal IV	44
A-MEC 1145	Measurement and Layout	44

ELECTIVE COURSES (Sheet Metal Layout Drafting-Option)

A-DFT 1151	Sheet Metal Layout Drafting I	44
A-DFT 1152	Sheet Metal Layout Drafting II	44
A-DFT 1153	Sheet Metal Layout Drafting III	44
A-DFT 1154	Sheet Metal Layout Drafting IV	44
MAT 1104	Trigonometry	33
DFT 1125	Descriptive Geometry	33

OTHER ELECTIVE COURSES

A-DFT 1107	Blueprint Reading (Structural)	33
A-MEC 1116	Metallurgy-Characteristics of Metals II	33
DFT 1104	Blueprint Reading	33
MAT 1102	Algebra	55
A-DFT 1122	Drafting	66
WLD 1103	Welding and Cutting	33
WLD 1104	Welding and Cutting (a. Theory	22
	(b. Lab	33
A-AHR 1123	Principles of Air Conditioning	33
A-AHR 1124	Air Conditioning & Refrigeration Service	33

A-MEC 1115 Metallurgy - Characteristics of Metals I 33

Investigates the properties of ferrous metals and tests to determine their uses. Instructions will include some chemical metallurgy to provide a background for the understanding of the physical changes and causes of these changes in metals. Physical metallurgy of ferrous metals, producing iron and steel, theory of alloys, shaping and forming, heat treatments for steel, surface treatments, alloy of special steel, classification of steels, and cast iron will be topics for study.
Prerequisite: None.

A-MEC 1116 Metallurgy - Characteristics of Metals II 33

Continuation of the study of physical metallurgy. The non-ferrous metals: bearing metals, (brass, bronze, lead), light metals (aluminum and magnesium), and copper and its alloys are studied. Powder metallurgy, titanium, zirconium, indium, vanadium, and also plastics are included in this course.
Prerequisite: A-MEC 1115.

A-MEC 1141 Sheet Metal I 44

Instruction is arranged to allow the trainee to become proficient in principles and practices of sheet metal layout and fabrication. The related mathematics blueprint reading, sketching, drawing of layouts, and the using of the tools of the trade are correlated in planning and producing the on-the-job projects. The related information is arranged in a logical sequence designed to promote the rapid advancement of the apprentice on the job. Spray painting of various production finishes is taught along with the different methods of corrosion prevention by protective coatings.
Prerequisite: None.

A-MEC 1142 Sheet Metal II 44

In solving the various problems assigned, the trainee should progress at his own with a minimum amount of supervision. Drawings and fabrication of fittings of round pipe using parallel line development through various transition pieces using triangulation method. A brief written description of the procedure used in laying out and fabricating the fitting is necessary. General questions must be answered that apply to the students work in the sheet metal trade.
Prerequisite: A-MEC 1141.

A-MEC 1143 Sheet Metal III 66

A study is made of working drawings, detailing, and layout for domestic and commercial installations; projects and fittings for exhaust, blowpipe, and refuse collecting systems; the application of sheet metal formulate in determining the area and volume of various fittings and projects. General questions must be discussed that apply to the on-the-job work of the apprentice.
Prerequisite: A-MEC 1142.

DFT 1104 Blueprint Reading: Mechanical 33

Interpretation and reading of blueprints. Information on the basic principles of the blueprint; lines, views, dimensioning procedures and notes.
Prerequisite: None.

DFT 1116 Blueprint Reading: Air Conditioning 33

A specialized course in drafting for the heating, air conditioning and refreigeration student. Emphasis will be placed on reading of blueprints that are common to the trade; blueprints of mechanical components, assembly drawings, wiring diagrams and schematics, floor plans, heating system plans, including duct and equipment layout plans, and shop sketches. The student will make tracings of floor plans and layout air conditioning systems.
Prerequisite: DFT 1122.

A-DFT 1121 Elementary Drafting 66

An introduction to drafting and the study of drafting practices. Instruction is given in the selection, use and care of instruments, single-stroke lettering, applied geometry, freehand sketching consisting of orthographic and pictorial drawings. Orthographic projection, reading and instrument drawing of principal views, single auxiliary views (primary), and double (oblique) auxiliary views will be emphasized. Dimensioning and note practices will be studied with reference to the American Standards Association practices. Methods of reproducing drawings will be included at the appropriate time.
Prerequisite: None.

A-DFT 1122 General Drafting 66

A course in practical mechanical drafting applied to the trades. The trainee will study simple and successive revolutions and their applications to practical problems. Sections and conventions will be studied and both detail and assembly sections will be drawn. Intersections and developments will be studied by relating the drawing to the sheet metal trades. Models of the assigned drawings will be made from construction paper, cardboard, or similar materials as a proof of the solution to the problems drawn. Special consideration of dimensioning tolerances, finishes and standard notations on drawings of casting, forgings and machine parts.
Prerequisite: A-DFT 1121.

A-AHR 1123 Principles of Air Conditioning 33

Work includes the selection of various heating, cooling and ventilating systems, investigation and control of factors affecting air cleaning, movement, temperature, and humidity. Use is made of psychrometric charts in determining needs to produce optimum temperature and humidity control. Commercial air conditioning equipment is assembled and tested. Practical sizing and balancing of ductwork is performed as needed.
Prerequisite: A-AHR 1122.

A-AHR 1128 Air Conditioning and Refrigeration Servicing 33

Emphasis is placed on the installation, maintenance, and servicing of equipment used in the cleaning, changing, humidification and temperature control of air in an air conditioned space. Installation of various ducts and lines needed to connect various components is made. Shop work involves burner operation, controls, testing and adjusting of air conditioning and refrigeration equipment, and location and correction of equipment failure.
Prerequisite: A-AHR 1123.

A-MEC 1168 Sheet Metal IV 66

An advanced study is made by developing working drawings and layout patterns for intricate articles, fittings, and projects in all branches of sheet metal work. Projects such as, rectangular-to-round double offset, psychrometric processes and charts, elbow boots, estimating the air conditioning, cooling and heating loads. A brief description of the procedure used in laying out or estimating the problems is required. Individual help is given each trainee in laying out such problems as three-piece rectangular-to-round elbow.
Prerequisite: A-MEC 1163.

A-DFT 1131 Sheet Metal Layout Drafting I 66

This course is designed to equip the sheet metal worker with the necessary technical knowledge in Layout Drafting to supplement actual experience gained on the job. The fundamentals of pattern development and layout of air conditioning and ventilating problems and sheet metal construction are presented. Surface development methods of prisms and other geometrical objects by the parallel line method are practiced.
Prerequisite: A-MEC 1161 or equivalent.

WLD 1108 Basic Welding and Cutting 33

Welding demonstrations by the instructor and practice by students in the welding shop. Safe and correct methods of assembling and operating the welding equipment. Practice will be given for surface welding; bronze welding, silver soldering, arc and gas-arc welding methods applicable to mechanical repair work.
Prerequisite: None.

A-DFT 1152 Sheet Metal Layout Drafting II 44

A comprehensive knowledge of the principles of radial line development may be obtained through this course. Patterns of various conical objects are developed in which these principles are applied. Many intersections of cylinders and cones, cones and prisms, and cones and cones are solved through layout drafting. Miscellaneous sheet metal fittings are developed through these methods. Weather caps, suction hook-ups, dust collectors and various ventilation systems are examples of these principles.
Prerequisite: A-DFT 1151 and A-MEC 1141.

A-DFT 1153 Sheet Metal Layout Drafting III 44

This course develops a thorough understanding of the principles of triangulation, the method used to lay out patterns of irregular objects. Skill in pattern development is acquired through the development of patterns for a variety of fittings and objects, such as square-to-rounds, Y-branches, shoe tees, dust collectors, fume hoods and other transistions.
Prerequisite: A-DFT 1152 and A-MEC 1142 or equivalent.

A-DFT 1154 Sheet Metal Layout Drafting IV 44

This is a course in which all methods of pattern development are used and short cuts developed. Complex fittings are designed and their patterns developed. Upon satisfactory completion of this course the apprentice or student should be able to cope with any layout problem. All types of duct systems, welded pipe systems, industrial guards for fans and machinery, roof ventilators for industrial plants, tanks, measuring cans and various other transition fittings. Skills in the saving of time, materials and effort are stressed when these layouts are made.
Prerequisite: A-DFT 1153 and A-MEC 1143 or equivalent.
Corequisite: A-MEC 1144 or equivalent.

A-DFT 1127 Blueprint Reading (Structural) 33

The student is trained to read structural steel detail drawings. These prints are consistent with accepted trade practices, structural fabrication, and erection procedures. Course includes the study of symbols, structural shapes, methods of connection; plate and tank development, and an introduction to beam and column loading.
Prerequisite: A-DFT 1124.

DFT 1125 Descriptive Geometry 33

Graphical analysis of space problems. The problems deal with practical design elements involving points, lines, planes, connectors, and a combination of these. Included are problems dealing with solid geometry theorems. Where applicable, each graphical solution shall be accompanied by the analytical solution.
Prerequisite: A-DFT 1152.

METALWORKING OCCUPATIONS APPRENTICESHIP

WELDING
OE-NCES 17.2306

INTRODUCTION

Purpose of Program

This curriculum was developed to fill the tremendous need for welders in North Carolina. The recently completed Manpower Survey shows quite clearly that many welders will be needed annually to fill present and projected vacancies in the state for the next ten years.

The content of this program is designed to give students sound understanding of the principles, methods, techniques and skills essential for successful employment in the welding field and metals industry.

The field of welding offers a person prestige, security and a future of continuous employment with steady advancement. It offers employment in practically any industry: shipbuilding, automotive, aircraft, guided missiles, atomic energy installations, railroads, construction, pipe fitting, tank building, production shops, job shops, and many others.

Job Description

Welders join metals by applying intense heat, and sometimes pressure, to melt the edges to form a permanent bond. Closely related to welding is "oxygen cutting." Of the more than 35 different ways of welding metals, arc, gas, resistance, modern "MIG" & "TIG" welding are the most important. Recent developments in "MIG" & "TIG" welding of aluminum alloys and other thin sheets makes a greater demand for welders.

The principal duty of the welder using manual techniques is to control the melting by directing the heat from either an electric arc or gas welding torch, and to add filler metal where necessary to complete the joint. He should possess a great deal of manipulative skill with a knowledge of jigs, welding symbols, mathematics, basic metallurgy, and blueprint reading. The use of automatic and semi-automatic welding equipment in production plants requires more skilled technicians and maintenance workers.

WELDING
OE-NCES 17.2306

REQUIRED BASIC COURSES

No.	Title	Hours
ENG 1101	Reading Improvement	22
ENG 1102	Communication Skills	33
MAT 1101	Fundamentals of Math	33
ISC 1101	Industrial Safety	33
PSY 1101	Human Relations	33
BUS 1101	Small Business Operations	33

REQUIRED RELATED COURSES

A-WLD 1120	Oxyacetylene Welding & Cutting	33
A-WLD 1121	Arc Welding	33
A-WLD 1112	Mechanical Testing & Inspection	33
A-WLD 1106	Intermediate Welding	33
A-WLD 1107	Advanced Welding	33
A-WLD 1108	Welding Process Applications	33
PHY 1101	Applied Science I	33
DFT 1104	Blueprint Reading: Mechanical	33
DFT 1117	Blueprint Reading: Welding	33
A-MEC 1113	Characteristics of Ferrous Metals	33
A-MEC 1114	Characteristics of Non-Ferrous Metals	33

ELECTIVE COURSES

DFT 1118	Pattern Development & Sketching	33
A-WLD 1124	Pipe Welding	33
A-WLD 1123	Inert Gas Welding	22
A-WLD 1122	Commercial and Industrial Practices	33
MAT 1103	Geometry	33
BUS 1105	Industrial Organizations	33

NOTE: On-the-job training takes the place of laboratory work except for demonstrations.

WELDING

COURSE DESCRIPTION

No.	Title	Hours
A-WLD 1106	Intermediate Welding	33

This is a combined welding course which gives the student experience in all types of welding. Fundamentals of inert gas welding is introduced using both argon and carbon dioxide for the shielded arc. Fabrication of metal structures, position welding, safety and care of equipment are stressed. Prerequisites: A-WLD 1120, A-WLD 1121.

No.	Title	Hours
A-WLD 1107	Advanced Welding	33

This is a combined course in all types of welding and cutting. It is designed to produce a more experienced welder with increased speed. The instruction includes non-ferrous alloys, alloy castings, tool steels and the more intricate welding procedures and applications. Prerequisites: A-WLD 1106, A-WLD 1120, and A-WLD 1121.

No.	Title	Hours
A-WLD 1109	Welding Processes Applications	66

A review in the principles and theory of various welding processes such as metallic arc welding, gas welding, arc and gas cutting, atomic hydrogen welding, thermit welding, carbon arc welding, inert-gas shielded arc current; ultrasonic welding of foil and gage wire, and vacuum electron beam welding. Special consideration is given to difficult problems encountered in welding certain joints made of special metals. Prerequisites: A-WLD 1106 and A-WLD 1107.

No.	Title	Hours
A-WLD 1112	Mechanical Testing and Inspection	33

The standard methods for mechanical testing of welds. The student is introduced to the various types of tests and testing procedures and performs the details of the test which will give adequate information as to the quality of the weld. Types of tests to be covered are: bend, destructive, free-bend, guided-bend, nick-tear, notched-bend, tee-bend, nondestructive, V-notch, Charpy impact, etc. Prerequisites: A-WLD 1120, A-WLD 1121.

A-WLD 1120 Oxyacetylene Welding and Cutting 33

Introduction to the history of oxyacetylene welding, the principles of welding and cutting, nomenclature of the equipment, assembly of units. Welding procedures such as practice of puddling and carrying the puddle, running flat beads, butt welding in the flat, vertical and overhead position, brazing, hard and soft soldering. Safety procedures are stressed throughout the program of instruction in the use of tools and equipment. Students perform mechanical testing and inspection to determine quality of the welds.
Prerequisite: None.

A-WLD 1121 Arc Welding 33

The operation of AC transformers and DC motor generator arc welding sets. Studies are made of welding tests, polarities, and electrodes for use in joining various metal alloys by the arc welding process. After the student is capable of running beads, butt and fillet welds in all positions are made and tested in order that the student may detect his weaknesses in welding. Safety procedures are emphasized throughout the course in the use of tools and equipment.
Prerequisite: None.

A-WLD 1122 Commercial and Industrial Practices 33

Designed to build skills through practices in simulated industrial processes and techniques: sketching and laying out on paper the size and shape description, listing the procedure steps necessary to build the product. Emphasis is placed on maintenance, repairing worn or broken parts by special welding applications, field welding and nondestructive tests and inspection.
Prerequisites: A-WLD 1120 and A-WLD 1121.

A-WLD 1123 Inert Gas Welding 22

Introduction and practical operations in the use of inert-gas-shield arc welding. A study will be made of the equipment, operation, safety and practice in the various positions. A thorough study of such topics as: principles of operation, shielding gases, filler rods, process variations and applications, manual and automatic welding.
Prerequisites: A-WLD 1120 and A-WLD 1121.

A-WLD 1124 Pipe Welding 33

Designed to provide practice in the welding of pressure piping in the horizontal, vertical, and horizontal fixed position using shielded metal arc welding processes according to Sections VIII and IX of the ASME code.
Prerequisite: A-WLD 1121.

A-MEC 1113 Metallurgy--Characteristics of Metals I 33

Investigates the properties of ferrous metals and tests to determine their uses. Instructions will include some chemical metallurgy to provide a background for the understanding of the physical changes and causes of these changes in metals. Physical metallurgy of ferrous metals, producing iron and steel, theory of alloys, shaping and forming, heat treatments for steel, surface treatments, alloy of special steel, classification of steels, and cast iron will be topics for study.
Prerequisite: None.

A-MEC 1116 Metallurgy--Characteristics of Metals II 33

Continuation of the study of physical metallurgy. The non-ferrous metals: bearing metals, (brass, bronze, lead), light metals (aluminum and magnesium), and copper and its alloys are studied. Power metallurgy, titanium, zirconium, indium, vanadium, and also plastics are included in this course.
Prerequisite: A-MEC 1113.

DFT 1104 Blueprint Reading: Mechanical 33

Interpretation and reading of blueprints. Information on the basic principles of the blueprint; lines, views, dimensioning procedures and notes.
Prerequisite: None.

DFT 1107 Blueprint Reading: Welding 33

A thorough study of trade drawings in which welding procedures are indicated. Interpretation, use and application of welding symbols, abbreviations, and specifications.
Prerequisite: DFT 1104.

DFT 1108 Pattern Development and Sketching 33

Continued study of welding symbols; methods used in layout of sheet steel; sketching of projects, jigs and holding devices involved in welding. Special emphasis is placed on developing pipe and angle layouts by the use of patterns and templates.
Prerequisite: None.

MECHANICAL DRAFTSMAN
OE-HCES 17.1300-1

INTRODUCTION

Purpose of Curriculum

This curriculum is designed to prepare students to enter the field of mechanical drafting. The first two courses are basic to all fields of drafting. The third and fourth contain specialization and related courses that prepare one to enter mechanical drafting occupations.

Each course is prepared to enable an individual to advance rapidly in drafting proficiency upon entering the field of work. Courses are arranged in sequence to develop drafting skills and proficiency in mathematics and science. The draftsman associates with many levels of personnel--administrative, engineers, technicians, skilled workmen--and must be able to communicate effectively with them. Courses to develop knowledge and skills in communication, human relations, safety, and industrial organization are provided to assist the student in developing understandings and confidence in his relations with other persons.

Job Description

Draftsman prepares clear, complete, and accurate working plans and detail drawings, from rough or detailed sketches or notes for engineering or manufacturing purposes, according to the specified dimensions: Makes final sketch of the proposed drawing, checking dimension of parts, materials to be used, the relation of one part to another, and the relation of the various parts to the whole structure. Makes any adjustments or changes necessary or desired. Exercises manual skill in the manipulation of triangle, T-square, and other drafting tools. He learns to letter proficiently on the drawings. Makes charts for representation of statistical data, and finished designs from sketches. Utilizes knowledge of various machines, engineering practices, mathematics, building materials, and other physical sciences to complete the drawings.

Mechanical draftsman performs the general duties of a draftsman and also specializes in making rough drafting sketches of proposed mechanical devices, and then drawing necessary details. Prepares accurate scale drawings of parts of machines from specifications.

INDUSTRIAL OCCUPATIONS

MECHANICAL DRAFTSMAN

REQUIRED BASIC COURSES

No.	Title	Hours
ENG 1101	Reading Improvement	22
ENG 1102	Communication Skills	33
ISC 1031	Industrial Safety	33
PSY 1101	Human Relations	33
BUS 1103	Industrial Organizations	33
MAT 1102	Algebra	33
MAT 1103	Geometry	33
MAT 1104	Trigonometry	33

REQUIRED RELATED COURSES

No.	Title	Hours
DFT 1104	Blueprint Reading: Mechanical	33
A-DFT 1101	Drafting	66
A-DFT 1102	Drafting	66
A-DFT 1123	Descriptive Geometry	33
A-DFT 1131	Mechanical Drafting	66
A-DFT 1132	Mechanical Drafting	66

ELECTIVE COURSES

No.	Title	Hours
ENG 1103	Report Writing	33
BUS 1103	Small Business Operations	33
A-MEC 1112*	Shop Processes	55
	a. Theory	22
	b. Shop *	33
A-MEC 1114*	Shop Processes	55
	a. Theory	22
	b. Shop*	33
A-MEC 1113	Metallurgy - Characteristics of Metals 1	33
A-MEC 1116	Metallurgy - Characteristics of Metals 2	33

* On-the-job training can be substituted for lab.

COURSE DESCRIPTIONS

DFT 1111 Blueprint Reading and Sketching 3S

Principles of interpreting blueprints and specifications common to the building trades. Practice in reading details for grades, foundations, floor plans, elevations, walls, doors and windows, and roofs of buildings. Development of proficiency in making three view and pictorial sketches.
Prerequisite: DFT 1110.

DFT 1112 Blueprint Reading and Sketching 3S

Designed to develop abilities in reading complex drawings in the masonry field. Blueprints of residential and commercial buildings will be studied with emphasis on the plot plan, floor plan, basement and/or foundation plan, walls and various detailed drawings of masonry work.
Prerequisite: DFT 1111.

DFT 1113 Blueprint Reading: Plumbing Trades 3S

Sketching diagrams and schematics, and interpretation of blueprints applicable to the plumbing trades. Emphasis will be on plumbing plans for domestic and commercial buildings. Piping symbols, schematics, diagrams and notes will be studied in detail. Applicable building and plumbing codes will be used for reference.
Prerequisite: DFT 1110.

DFT 1116 Blueprint Reading: Air Conditioning 3S

A specialized course in drafting for the heating, air conditioning and refrigeration student. Emphasis will be placed on reading of blueprints that are common to the trade; blueprints of mechanical components, assembly drawings, wiring diagrams and schematics, floor plans, heating system plans including duct and equipment layout plans, and shop sketches. The student will make tracings of floor plans and layout air conditioning systems.
Prerequisite: DFT 1122.

A-DFT 1121 Elementary Drafting 6S

An introduction to drafting and the study of drafting practices. Instruction is given in the selection, use and care of instruments, single-stroke lettering, applied geometry, freehand sketching consisting of orthographic and pictorial drawings. Orthographic projection, reading and instrument drawing of principal views, single auxiliary views (primary), and double (oblique) auxiliary views will be emphasized. Dimensioning and note practices will be studied with reference to the American Standards Association practices. Methods of reproducing drawings will be included at the appropriate time.
Prerequisite: None.

A-DFT 11122 General Drafting 66

A course in practical mechanical drafting applied to the trades. The trainee will study simple and successive revolutions and their applications to practical problems. Sections and conventions will be studied and both detail and assembly sections will be drawn. Intersections and developments will be studied by relating the drawing to the sheet metal trades. Models of the assigned drawings will be made from construction paper, cardboard, or similar materials as a proof of the solution to the problems drawn. Special consideration of dimensioning tolerances, finishes and standard notations on drawings of castings, forgings and machine parts.
Prerequisite: A-DFT 11121.

DFT 11125 Descriptive Geometry 33

Graphical analysis of space problems. The problems deal with practical design elements involving points, lines, planes, connectors, and a combination of these. Included are problems dealing with solid geometry theorems. Where applicable, each graphical solution shall be accompanied by the analytical solution.
Prerequisite: A-DFT 11121.

A-DFT 11131 Drafting: Mechanical 66

An introduction to mechanical drafting beginning with problems concerning precision and limit dimensioning. Methods of fastening materials, and fasteners: keys, rivets, springs, and welding. Symbols will be studied and drawings will be made involving these items. Principles of design will be introduced with the study of basic mechanisms of motion transfer; gears, cams, power trains, pulleys, belting and methods of specifying and calculating dimensions will be studied. Drawings will be made involving these mechanisms.
Prerequisite: A-DFT 11122.

A-DFT 11132 Drafting: Mechanical 66

Principles of design sketching, design drawings, layout drafting, detailing from layout drawings, production drawings and simplified drafting practices constitute areas of study. Forging and casting drawings will be made from layouts. Specifications, parts list and bill of materials are emphasized in this course. The student will develop a complete set of working drawings of a tool, jig, fixture or simple machine and learn principles of design, handbook and manual usage.
Prerequisite: A-DFT 11131.

DFT 1106 Blueprint Reading: Mechanical 33

Interpretation and reading of blueprints. Information on the basic principles of the blueprint; lines, views, dimensioning procedures and notes.
Prerequisite: None.

A-MEC 1112* Shop Processes 33

Study of practices used in metalworking shops. Introduction to how materials can be utilized, and to the processes of shaping, forming and fabricating of metals. Demonstration of the metalworking lathes, grinders, drills, milling machines, shapers, planers, saws, broachers, gear cutting machines and finishing machines. A study of the capabilities of these machines.
Prerequisite: None.

A-MEC 1114* Shop Processes 33

Comparison of the unit-production and mass-production systems. Casting, forging and allied processes, welding and sheet metal working processes are demonstrated and discussed. Mass-production methods are studied in relationship to precision dimensional control.
Prerequisite: A-MEC 1112.

A-MEC 1113 Metallurgy - Characteristics of Metals I 33

Investigates the properties of ferrous metals and tests to determine their uses. Instructions will include some chemical metallurgy to provide a background for the understanding of the physical changes and causes of these changes in metals. Physical metallurgy of ferrous metals, producing iron and steel, theory of alloys, shaping and forming, heat treatments for steel, surface treatments, alloy of special steel, classification of steels, and cast iron will be topics for study.
Prerequisite: None.

A-MEC 1116 Metallurgy - Characteristics of Metals II 33

Continuation of the study of physical metallurgy. The non-ferrous metals: bearing metals, (brass, bronze, lead), light metals (aluminum and magnesium), and copper and its alloys are studied. Powder metallurgy, titanium, zirconium, indium, vanadium, and also plastics are included in this course.
Prerequisite: A-MEC 1113.

* On-the-job training can be substituted for lab.

SERVICE TRADES
MECHANICS AND REPAIRMAN

APPRENTICESHIP

AUTO BODY REPAIRMAN

OE-NCES 17.0301

INTRODUCTION

Purpose of Program

The field of automotive body repair and painting needs many more well-trained people to meet the growing demand for the many special skills in this area of employment. In this program, much of the students' time in the shop is devoted to learning skills and practicing these skills on car bodies and their component parts. Every apprentice is given these practical experiences by working on actual on-the-job situations. The practical experience and related instruction provide an ideal way to prepare the students for entry into an occupation that offers many job opportunities.

This type of instruction includes reading and interpreting blueprints, charts instruction and service manuals, and wiring diagrams. The apprentice learns to prepare orders for repairs and parts, as well as estimates and statements for adjusters.

Job Description

Graduates of the Auto Body Repair Program are qualified for jobs in which they remove dents in automobile bodies and fenders; take off fenders and replace them with new ones; straighten frames, doors, hoods, and deck lids; and align wheels. In their work, these craftsmen operate modern welding and brazing equipment, and also, make tests on and repair engine cooling systems. Auto body repairmen shrink stretched metal and prepare it for painting. They are called on to paint fenders and/or panels as well as to paint a complete vehicle.

In addition to the above duties, auto body repairmen remove, cut, fit, and install glass. They are required to remove and install interior trim; cut, sew, and install headings and seat covers; repair and replace upholstery and fabric tops of vehicles; and rebuild springs and padding. After gaining experience, many of these craftsmen open their own businesses or become body shop foremen, supervisors, or managers.

SERVICE TRADES

AUTO BODY REPAIR

REQUIRED BASIC COURSES

No.	Title	Hours
ENG 1101	Reading Improvement	22
ENG 1102	Communication Skills	33
MAT 1101	Fundamentals of Mathematics	55
PSY 1101	Human Relations	33
ISC 1001	Industrial Safety	33
BUS 1103	Small Business Operations	33
PHY 1101	Applied Science	55
PHY 1102	Applied Science	55
WLD 1101	Basic Gas Welding	33
WLD 1103	Auto Body Welding	33

REQUIRED RELATED COURSES

A-AUT 1111	Auto Body Repair	33
A-AUT 1112	Auto Body Repair	33
A-AUT 1113	Metal Finishing and Painting	33
A-AUT 1114	Body Shop Applications	33
A-AUT 1115	Trim, Glass and Radiator Repair	22

ELECTIVE COURSES

A-AUT 1116	Auto Body Repair Estimating	33
A-AUT 1117	Major Auto Body Repair	33
A-AUT 1118	Auto Shop Operations	22
A-AUT 1123	Automotive Chassis and Suspension Systems	33

SERVICE TRADES

AUTO BODY REPAIR

COURSE DESCRIPTIONS

No. Title Hours

A-AUT 1111 Auto Body Repair 33

Basic principles of automobile construction, design, and manufacturing. A thorough study of angles, crown, and forming of steel into the complex contour of the present day vehicles. The student applies the basic principles of straightening, aligning, and painting of damaged areas.
Prerequisite: None.

A-AUT 1112 Auto Body Repair 33

A thorough study of the requirements for a metal worker, including the use of essential tools, forming fender flanges and beads, and straightening typical auto body damage. The student begins acquiring skills such as shaping angles, crowns, and contour of the metal of the body and fenders. Metal working and painting.
Prerequisites: A-AUT 1111, WLD 1101, PHY 1101, MAT 1101.

WLD 1105 Auto Body Welding 33

Welding practices on material applicable to the installation of body panels and repairs to doors, fenders, hoods, and deck lids. Student runs beads, does butt and fillet welding. Performs tests to detect strength and weaknesses of welded joints. Safety procedures are emphasized throughout the course.
Prerequisite: WLD 1101.

A-AUT 1113 Metal Finishing and Painting 33

Development of the skill to shrink stretched metal, soldering and leading, and preparation of the metal for painting. Straightening of doors, hoods, and deck lids; fitting and aligning. Painting fenders and panels, spot repairs, and complete vehicle painting; the use and application of power tools.
Prerequisites: A-AUT 1112, WLD 1105.

A-AUT 1114 Body Shop Applications 33

General introduction and instruction in the automotive frame and front end suspension systems, the methods of operation and control, and the safety of the vehicle. Unit job application covers straightening of frames and front wheel alignment. The student applies all phases of training. Repair order writing, parts purchasing, estimates of damage, and developing the final settlement with the adjuster.
Prerequisites: A-AUT 1113, PHY 1102, DFT 1101.

A-AUT 1115 Trim, Glass and Radiator Repair 22

Methods of removing and installing interior trim; cutting, sewing and installing headlinings, seat covers, and door trim panels; painting of trim parts and accessories. Glass removal, cutting, fitting, and installation. The student gains a thorough knowledge of the engine cooling system and repairs and replaces damaged cooling system components. Tests are made to insure normal engine cooling operation.
Prerequisites: A-AUT 1112, WLD 1105.

A-AUT 1116 Auto Body Repair: Estimating 33

General estimating is stressed with regard to securing business from the insurance company and the car owner. Glass work is estimated as well as all phases of body work. Work is estimated on a time basis and actual wrecked cars are used. Instruction is given in the use of handbooks, interpreting specifications, and applying such information to the job.
Prerequisites: All Basic Auto Body Courses or Equivalent Exerpience.

A-AUT 1117 Major Auto Body Repair Planning 33

In this course the student does major planning for repair work which consists of restoring a complete wreck to the original contour and finish including frame, front end, and all alignment procedures and glass work. Estimate and procedure sheets are required along with a written report if necessary.
Prerequisites: All Basic Auto Body Courses or Equivalent Experience.

A-AUT 1118 Auto Body Shop Operations 22

Setting up, equipping, and operating a body shop are covered in this course. An adequate list of equipment, placing of major equipment and the spray booth operations are considered. A procedure of how to process a typical job is written.
Prerequisite: All Major Auto Body Courses or Equivalent Experience.

A-AUT 1110 Advanced Painting & Color Theory 66

Instruction is offered in removing and sanding old paint surfaces, masking off areas, mixing paint, spraying paint, cutting, and polishing surfaces. Automotive color theory includes color matching, color mixing, paint formulas, use and care of painting equipment and care of paint thinners. The use of current manufacturers' color charts is also included.
Prerequisite: A-AUT 1113 or Equivalent Experience.

A-AUT 1123 Automotive Chassis and Suspension Systems 55

Principles and functions of the components of automotive chassis. Practical job instruction in adjusting and repairing of suspension, and steering systems. Units to be studied will be shock absorbers, springs, steering systems, steering linkage, and front end and alignment.
Prerequisite: PME 1102.

WLD 1101 Basic Gas Welding 55

Welding demonstrations by the instructor and practice by students in the welding shop. Safe and correct methods of assembling and operating the welding equipment. Practice will be given for surface welding; bronze welding, silver soldering, and flame-cutting methods applicable to mechanical repair work.
Prerequisite: None.

SERVICE TRADES
MECHANICS AND REPAIRMEN

APPRENTICESHIP

AUTOMOTIVE MECHANICS
USOE 17.0302

INTRODUCTION

Purpose of Program

This guide outlines a training program for developing the basic knowledge and skills needed to inspect, diagnose, repair or adjust automotive vehicles. Manual skills are developed in practical shop work. Thorough understanding of the operating principles involved in the modern automobile comes in class assignments, discussion, and shop practice.

Complexity in automotive vehicles increases each year because of scientific discovery and new engineering. These changes are reflected not only in passenger vehicles, but also in trucks, buses and a variety of gasoline-powered equipment. This program provides a basis for the student to compare and adapt to new techniques for servicing and repair as vehicles are changed year by year.

Job Description

Automobile mechanics maintain and repair mechanical, electrical, and the chassis of passenger cars, trucks, and buses. In some communities and rural areas they also may service tractors or marine engines and other gasoline-powered equipment. Mechanics inspect and test to determine the causes of faulty operation. They repair or replace defective parts to restore the vehicle or machine to proper operating condition. They use shop manuals and other technical publications, such as, Motor's Auto Repair Manual and New Auto Repair Manual by Chilton for data and specifications.

Automotive mechanics in smaller shops usually are general mechanics qualified to perform a variety of repair jobs. A large number of automobile mechanics specialize in particular types of repair work. For example, some may specialize in repairing only power steering and power brakes, or automatic transmissions. Usually such specialists have an all-round knowledge of automotive repair and may occasionally be called upon to do other types of work.

AUTOMOTIVE MECHANIC

REQUIRED BASIC COURSES

No.	Title	Hours
ENG 1101	Reading Improvement	22
ENG 1102	Communication Skills	22
MAT 1101	Fundamentals of Mathematics	44
PSY 1101	Human Relations	22
ISC 1001	Industrial Safety	22
BUS 1103	Small Business Operations	22
PHY 1101	Applied Science	44
PHY 1102	Applied Science	44
WLD 1104	Basic Welding and Cutting	22
DFT 1101	Schematics and Diagrams: Power Mechanics	33

REQUIRED RELATED COURSES

A-AUT 1101	Introduction to Automobile Mechanics	33
A-AUT 1102	Internal Combustion Engines I	33
A-AUT 1103	Internal Combustion Engines II	33
A-AUT 1104	Ignition and Fuel Systems I	33
A-AUT 1105	Ignition and Fuel Systems II	33
A-AUT 1106	Automotive Electrical Circuits	66
A-AUT 1107	Automatic Transmissions I	66
A-AUT 1108	Automotive Shop Service	22
A-AUT 1109	Service Management (Auto)	33
A-AUT 1121	Braking Systems I	33
A-AUT 1122	Suspensions and Braking Systems II	33
A-AUT 1123	Automobile Chassis and Suspension Systems	33
A-AUT 1124	Automobile Power Train Systems	33
A-AUT 1125	Automotive Diagnosis and Servicing	33
A-AHR 1101	Automotive Air Conditioning	22

ELECTIVE COURSES

A-AUT 1110	Automotive Machine Shop	66
A-AUT 1127	Automatic Transmissions II	22
A-AUT 1128	Automatic Transmissions III	22
DFT 1104	Blueprint Reading: Mechanical	33
DFT 1105	Blueprint Reading: Mechanical	33
MEC 1112	Machine Shop Processes	66
A-MEC 1115	Characteristics of Metals I	33
A-MEC 1116	Characteristics of Metals II	33

SERVICE TRADES

AUTOMOTIVE MECHANICS

COURSE DESCRIPTIONS

No. Title Hours

A-AUT 1101 Automotive Mechanics I 33

This is a general survey course for automobile apprentices to be studied in conjunction with schematics and diagrams. Instruction is given in the history of the trade and the meaning of apprenticeship; care and use of tools and power equipment; safety; study of general maintenance work starting with the engine and including the chassis, frame, steering front end, brakes, shock absorbers; lubricants and other materials used.
Co-Requisite: DFT 1101 Schematics and Diagrams.

A-AUT 1102 Internal Combustion Engines I 33

Development of a thorough knowledge and ability in using, maintaining, and storing the various hand tools and measuring devices needed in engine repair work. Study of the construction and operation of components of internal combustion engines. Testing of engine performance; servicing and maintenance of pistons, valves, cams and camshafts, fuel and exhaust systems, cooling systems; proper lubrication; and methods of testing, diagnosing and repairing.
Prerequisite: None.

A-AUT 1103 Internal Combustion Engines II 33

This course is designed to further acquaint the student with the design, operation, trouble-shooting and service procedures of the modern gasoline engines. Adequate service and technical engine data are presented to assist the students with their on-the-job experiences in engine servicing.
Prerequisites: DFT 1101 and A-AUT 1101.

A-AUT 1104 Ignition and Fuel Systems I 33

A thorough study of the ignition and fuel systems of the automobile. Battery cranking mechanism, generator, ignition, accessories and wiring; fuel pumps, carburetors, and fuel injectors. Characteristics of fuels, types of fuel systems, special tools, and testing equipment for the fuel and ignition system.
Prerequisite: A-AUT 1102.

A-AUT 1105 Ignition and Fuel Systems III 33

This course includes instruction on modern A.C. and D. C. generators and control units, carburetion, and transistor controlled systems. The construction function, operation, trouble-shooting procedures are studied and servicing and testing requirements are stressed. Laboratory demonstrations of disassembly and reassembly of components, performance of required bench tests should be made with the students participating when possible.
Prerequisite: A-AUT 1102.

A-AUT 1106 Automotive Electrical Circuits 44

Through lecture, demonstration, and laboratory experience the horn circuit, windshield wiper circuit, instrument circuit, lighting circuit, and electric power accessory circuits are studied. Time also is devoted to the understanding and use of vehicle wiring diagrams. The students have an opportunity to participate in disassembly and reassembly of components and the bench testing needed to determine serviceability.
Prerequisite: A-AUT 1105.

A-AUT 1108 Automotive Shop Service 22

New vehicle service routine, installation of accessories, body service and inspection. Shop routine for diagnosis and repair of used vehicles. Students are expected to develop work standards in quality and quantity of work produced.
Prerequisite: All Required Related Courses.

A-AUT 1109 Service Management (Auto) 33

The automotive service management course is designed to offer the students a practical orientation to the management functions of modern Dealerships or Service Centers. Accent is placed on those subjects that directly or indirectly influence the efficiency of the service department.
Prerequisite: Industrial Apprentice or Auto Mechanics.

A-AUT 1121 Braking Systems I 33

A complete study of various braking systems employed on automobiles and light weight trucks. Emphasis is placed on how they operate, proper adjustment, and repair.
Prerequisite: PHY 1102.

A-AUT 11122 Suspensions and Braking Systems III 33

This is an advanced course in modern up-to-date automotive suspensions and brakes. Basic suspension and brake service problems will be reviewed and followed by instruction on current power brake and disc brake systems, power steering systems, and suspension correction procedures for light-frame damage.
Prerequisite: A-AUT 11121.

A-AUT 11123 Automotive Chassis and Suspension Systems 33

Principles and functions of the components of automotive chassis. Practical job instruction in adjusting and repairing of suspension, and steering systems. Units to be studied will be shock absorbers, springs, steering systems, steering linkage, and front end and alignment.
Prerequisite: PME 11102.

A-AUT 11124 Automotive Power Train Systems 33

Principles and functions of automotive power train systems: clutches, transmission gears, torque converters, drive shaft assemblies, rear axles and differentials. Identification of troubles, servicing, and repair.
Prerequisites: PMW 11102, AUT 11123.

A-AUT 11125 Automotive Servicing 33

Emphasis is on the shop procedures necessary in determining the nature of troubles developed in the various component systems of the automobile. Troubleshooting of automotive systems, providing a full range of experiences in testing, adjusting, repairing and replacing.
Prerequisites: AUT 11123, AUT 11121, AMR 11101.

A-AMR 11101 Automotive Air Conditioning 22

General introduction to the principles of refrigeration; study of the assembly of the components and connections necessary in the mechanisms, the methods of operation, and control; proper handling of refrigerants in charging the system.
Prerequisite: PMW 11102.

WLD 1103 Basic Welding and Cutting 33

Welding demonstrations by the instructor and practice by students in the welding shop. Safe and correct methods of assembling and operating the welding equipment. Practice will be given for surface welding, bronze welding, silver soldering, and flame-cutting, arc and gas-arc welding methods applicable to mechanical repair work.
Prerequisite: None.

DFT 1101 Schematics and Diagrams: Power Mechanics 33

Interpretation and reading of blueprints. Development of ability to read and interpret blueprints, charts, instruction and service manuals, and wiring diagrams. Information on the basic principles of lines, views, dimensioning procedures, and notes.
Prerequisite: None.

A-AUT 1107 Automatic Transmissions I 66

This course is designed to give the student all the knowledge he needs to maintain and repair the hydramatic transmissions, and a general knowledge of the automatic transmission in common use.
Prerequisite: All basic auto courses.

A-AUT 1127 Automatic Transmissions II 22

This course is designed to give the student all the knowledge he needs to maintain and repair the Fordomatic, Mercomatic and Borg-Warner transmissions.
Prerequisites: All basic auto courses.

A-AUT 1128 Automatic Transmissions III 22

This course is designed to give the student all the knowledge he needs to maintain and repair the dynaflow, powerglide and power flight transmissions.
Prerequisite: All basic auto courses.

A-AUT 1113 Automotive Machine Shop 66

Students learn to restore worn automobile parts by using the various machine tools such as the cylinder boring bar, wrist pin fitters, crank shaft grinders, automatic transmission testers, auto and truck brake drum lathes and various tool room machines. Related technical information is given whenever needed to complete the various operations assigned. He should be able to repair or service minor ailments pertaining to the machinery he is working on.
Prerequisite: All basic auto courses.

DFT 1104 Blueprint Reading: Mechanical 33

Interpretation and reading of blueprints. Information on the basic principles of the blueprint; lines, views, dimensioning procedures and notes.
Prerequisite: None.

DFT 1105 Blueprint Reading: Mechanical 33

Further practice in interpretation of blueprints as they are used in industry; study of prints supplied by industry; making plans of operations; introduction to drafting room procedures; sketching as a means of passing on ideas, information and processes.
Prerequisite: DFT 1104.

MEC 1112 Machine Shop Processes 66

To acquaint the student with the procedures of layout work and the correct use of hand and machine tools. Experiences in the basic fundamentals of drill press and lathe operation; hand grinding of drill bits and lathe tools; set-up work applied to the trade.
Prerequisite: None.

A-MEC 1113 Characteristics of Metals I 33

Investigates the properties of ferrous metals and tests to determine their uses. Instructions will include some chemical metallurgy to provide a background for the understanding of the physical changes and causes of these changes in metals. Physical metallurgy of ferrous metals, producing iron and steel, theory of alloys, shaping and forming, heat treatments for steel, surface treatments, alloy of special steel, classification of steels, and cast iron will be topics for study.
Prerequisite: None.

A-MEC 1114 Characteristics of Metals II 33

Continuation of the study of physical metallurgy. The non-ferrous metals: bearing metals, (brass, bronze, lead), light metals (aluminum and magnesium), and copper and its alloys are studied. Powder metallurgy, titanium, zirconium, indium, vanadium, and also plastics are included in this course.
Prerequisite: A-MEC 1113.

SERVICE TRADES
MECHANICS & REPAIRMEN

APPRENTICESHIP

FARM MACHINERY
OE-NOES 17.0300

INTRODUCTION

Purpose of Program

The history of the development and introduction of farm machinery is largely the history of what we call "modern civilization."[1] The introduction of tools to cultivate the soil and lighten the labor of the farmer was immediately reflected in an improvement of the standard of living. The major factor in this growth and development has been the replacement of horsepower by power developed from gasoline and electricity.

As agriculture has become mechanized the need for trained specialists has increased. The hoe and scythe of the horse-drawn plow and rake required little repair or service that could not be provided on the farm. Modern machinery, however, is complicated and intricate and its general adoption and widespread use have created new areas of business opportunity.

This program is organized to provide a broad training to permit entrance into the field best suited to the interest and aptitude of the graduate. Emphasis is placed on the basic fundamental theory and related laboratory and shop techniques with specialization to be developed later in employment.

Job Description

Graduates of this program can quickly adapt themselves for employment in the areas of sales, service, distribution, installation and maintenance. They may estimate cost and plan equipment installations or provide the service that must be done, not in the factory, but in the field, and done by personnel who thoroughly understand the problems of the farmer-purchaser.

They will make inspections and tests to determine the causes of faulty operation, and repair or replace defective parts to restore the tractor or other gasoline-powered equipment to proper operating condition. They may occasionally be called upon to render service on other types of equipment such as pumps and sprayers, barn and diary equipment, ventilation and electrical equipment found on the farm.

FARM MACHINERY
OE-CODE 17.0301

REQUIRED BASIC COURSES

No.	Title	Hours
ENG 1101	Reading Improvement	22
ENG 1102	Communication Skills	33
MAT 1101	Fundamentals of Math	55
PHY 1101	Applied Science	55
PHY 1102	Applied Science	55
PSY 1101	Human Relations	33
ISC 1001	Industrial Safety	33
BUS 1103	Small Business Operations	33

REQUIRED RELATED COURSES

A-PME 1101	Internal Combustion Engines	33
A-PME 1102	Engine Electrical & Fuel Systems	55
A-PME 1113	Farm Machinery Hydraulics Systems	33
A-PME 1114	Farm Machinery Power Trains	33
A-PME 1115	Farm Machinery Suspensions and Implements	33
A-PME 1116	Farm Machinery Service and Repair	33
DFT 1101	Schematics & Diagrams: Power Mechanics	33
WLD 1101	Basic Gas Welding	33
WLD 1102	Basic Arc Welding	33

ELECTIVE COURSES

DFT 1104	Blueprint Reading: Mechanical	33
DFT 1105	Blueprint Reading: Mechanical	33
MEC 1112	Machine Shop Processes	66
A-MEC 1115	Characteristics of Metals I	33
A-MEC 1116	Characteristics of Metals II	33

COURSE DESCRIPTION

No.	Title	Hours
A-PME 1101	Internal Combustion Engines	33

Development of a thorough knowledge and ability in using, maintaining, and storing the various hand tools and measuring devices needed in engine repair work. Study of the construction and operation of components of internal combustion engines. Instruction is given in testing of engine performance; servicing and maintenance of pistons, valves, cams and camshafts, fuel and exhaust systems, cooling systems; proper lubrication; and methods of testing, diagnosing and repairing.
Prerequisite: None.

No.	Title	Hours
A-PME 1102	Engine Electrical and Fuel Systems	55

A thorough study of the electrical and fuel systems of the automobile. Battery cranking mechanism, generator, ignition, accessories and wiring; fuel pumps, carburetors, and fuel injectors. Characteristics of fuels, types of fuel systems, special tools, and testing equipment for the fuel and electrical system.
Prerequisite: A-PME 1101.

No.	Title	Hours
A-PME 1113	Farm Machinery Hydraulic Systems	33

A concentrated investigation of tractor hydraulic systems consisting of hydraulic principles and components of various hydraulic systems. Hydrostatics, basic circuits, fluids, hydrodynamics and automatic draft control. Identification of trouble, servicing, and repair.
Prerequisite: A-PME 1101.

No.	Title	Hours
A-PME 1114	Farm Machinery Power Trains	33

Principles and functions of tractor power train systems: clutches, bearings, shafts, and cases, gears and gear trains, differentials, final drives, and planetary systems.
Prerequisite: A-PME 1101.

A-PME 1115 Farm Machinery Suspensions and Implements 33

Principles and functions of the components of tractor suspensions. Practical instruction in adjustment and repair of suspension, steering, braking, and hitching systems.

Students will receive instruction in assembly, adjustment, operation, maintenance and repair of tractor-drawn and mounted equipment. They will also study the principles of operation and diagnosis and correction of troubles in tillage, planting and seeding, pest control and harvesting equipment.
Prerequisite: A-PME 1101.

A-PME 1116 Farm Machinery Service and Repair 33

Opportunity for the student to practice principles and techniques learned in previous courses by means of service and repair work that can be made available. A close simulation to an actual farm machinery shop situation will be maintained, and effort will be made to give the student a full range of testing and servicing experience under both shop and field conditions.
Prerequisite: A-PME 1101.

DFT 1101 Schematics and Diagrams: Power Mechanics 33

Interpretation and reading of schematics and diagrams. Development of ability to read and interpret blueprints, charts, instruction and service manuals, and wiring diagrams. Information on the basic principles of lines, views, dimensioning procedures, and notes.
Prerequisite: None.

WLD 1101 Basic Gas Welding 33

Welding demonstrations by the instructor and practice by students in the welding shop. Safe and correct methods of assembling and operating the welding equipment. Practice will be given for surface welding; bronze welding, silver soldering, and flame-cutting methods applicable to mechanical repair work.
Prerequisite: None.

WLD 1102 Basic Arc Welding 33

Welding demonstrations by the instructor and practice by students in the use of the arc welding process to fabricate steel. Welded joints are discussed and welded in various positions. Care and maintenance of the arc welder are applied in this course.
Prerequisite: None.

DFT 1104 Blueprint Reading: Mechanical 33

Interpretation and reading of blueprints. Information on the basic principles of the blueprint; lines, views, dimensioning procedures and notes.
Prerequisite: None.

DFT 1105 Blueprint Reading: Mechanical 33

Further practice in interpretation of blueprints as they are used in industry; study of prints supplied by industry; making plans of operations; introduction to drafting room procedures; sketching as a means of passing on ideas, information and processes.
Prerequisite: DFT 1104.

MEC 1112 Machine Shop Processes 66

To acquaint the student with the procedures of layout work and the correct use of hand and machine tools. Experiences in the basic fundamentals of drill press and lathe operation; hand grinding of drill bits and lathe tools; set-up work applied to the trade.
Prerequisite: None.

A-MEC 1115 Characteristics of Metals I 33

Investigates the properties of ferrous metals and tests to determine their uses. Instructions will include some chemical metallurgy to provide a background for the understanding of the physical changes and causes of these changes in metals. Physical metallurgy of ferrous metals, producing iron and steel, theory of alloys, shaping and forming, heat treatments for steel, surface treatments, alloy of special steel, classification of steels, and cast iron will be topics for study.
Prerequisite: None.

A-MEC 1116 Characteristics of Metals II 33

Continuation of the study of physical metallurgy. The non-ferrous metals: bearing metals, (brass, bronze, lead), light metals (aluminum and magnesium), and copper and its alloys are studied. Powder metallurgy, titanium, zirconium, indium, vanadium, and also plastics are included in this course.
Prerequisite: A-MEC 1115.

APPRENTICESHIP EDUCATION

SECTION III

APPENDIX

Page

I. RESOURCE REFERENCES 1

II. PAMPHLETS FOR GUIDANCE OF HIGH SCHOOL STUDENTS 2

III. NATIONAL STANDARDS OF APPRENTICESHIP GUIDES 3

- A. General Guides 3
- B. Building Trades 3 - 4
- C. Service Trades 4
- D. Other Trades 4

IV. SUGGESTED GUIDES FOR SELECTION OF TRAINING CONTENT 5

V. REFERENCES AND OUTLINES - MANUALS OF RELATED INSTRUCTION 6

VI. SAMPLE FORMS USED IN APPRENTICESHIP TRAINING

- A. Apprenticeship Agreement 7 - 8
- B. Work Report - Forms 9 -10
- C. Attendance Report - Related Instruction 11
- D. Training Record - Automotive 12
- E. Employment Record 13
- F. Local Advisory Craft Committee 14
- G. Addresses for Some Textbook Companies 15

APPRENTICE EDUCATION

RESOURCE REFERENCES:

Apprenticeship - Past and Present. Washington, D. C. U. S. Department of Labor, Bureau of Apprenticeship.

Apprenticeship Standards. U. S. Labor Department, Bureau of Apprenticeship and Training. Reprint--Ford Motor Company. 1959.

Apprentice Training. Washington, D. C. U. S. Department of Labor, Bureau of Apprenticeship and Training.

Community Colleges, Technical Institutes and Industrial Education Centers. (Chapter 115A, General Statutes of North Carolina.)

Curriculum Materials for Trade and Industrial Education. Washington, D. C. U. S. Department of H.E.W., Office of Education, #OE 84023-A, Division of Public Documents. 1963.

Manual of the North Carolina Apprenticeship System. Raleigh, North Carolina. The North Carolina Department of Labor.

North Carolina Standards for Apprenticeship Training. Raleigh, North Carolina. Compiled and Edited by Roland L. Roy, Coordinator Related Training for Apprentices, Department of Community Colleges. December, 1965.

Organization and Effective Use of Advisory Committees. Washington, D. C. U. S. Department of Health, Education, and Welfare, Office of Education PE-84009, Division of Public Documents.

Related Instruction for Apprentices. Pontiac, Michigan. The School District of the City of Pontiac. 1965.

Setting Up An Apprenticeship Program. Washington, D. C. U. S. Department of Labor, Manpower Administration.

PAMPHLETS FOR GUIDANCE OF HIGH SCHOOL STUDENTS

"Earn While You Learn" Through Apprenticeship Training. Raleigh, North Carolina. State Apprenticeship Council, North Carolina Department of Labor.

Find Your Future in Construction. Charlotte, North Carolina. Construction Education Foundation of North Carolina and Carolinas Branch. 1967.

Lets Talk About Your Future in Apprenticeship. Raleigh, North Carolina. Division of Apprenticeship Training, North Carolina Department of Labor.

Manpower Needs of The Future. Paper presented at the 59th Annual American Vocational Association Convention in Miami by Stanley H. Ruttenberg, Manpower Administrator. December 7, 1965.

The National Apprenticeship Program. U. S. Department of Labor. 1966.

NATIONAL STANDARDS OF APPRENTICESHIP GUIDES

The following Standards of Apprenticeship may be ordered from the U. S. Department of Labor. These will be helpful in preparing new programs.

GENERAL

- How to Train Workers on the Job 0-238-936
- Trade and Industrial Education for the 1960's OE-84001
- Vocational-Technical Education for American Industry Circular No. 530
- Handbook for Young Workers 0-774-018
- Safety in Industry 0-778-674
- Occupational Safety Aid, Safe Lifting 0-215-345

BUILDING TRADES

- National Apprenticeship and Training Standards for Glaziers and Glassworkers
- The Stained Glass Industry
- National Roofers Apprenticeship and Training Standards 0-755-223
- National Bricklaying Apprenticeship Program and Standards 0-219-436
- National Apprenticeship and Training Standards for Cement Masonry, Asphalt, and Composition Trade
- National Standards of Apprenticeship for the Crafts of the Plastering Industry
- National Standards of Apprenticeship for the Lathing Industry
- National Plumbing Apprenticeship Standards 16-46518-6
- National Steamfitter/Pipefitter Apprenticeship Standards
- A Pneumatic Control Training Program Designed Especially for The United Association Journeyman and Apprentice - Steamfitters/Pipefitters
- National Steamfitter/Pipefitter Apprenticeship Standards
- National Painting and Decorating Apprenticeship and Training Standards 0-551463

- National Apprenticeship and Training Standards for the Electrical Contracting Industry
- National Apprenticeship and Training Standards for the Sheet Metal Industry 0-774-847

PRINTING TRADES

Tomorrow's Pressmen 0-776-747

SERVICE TRADES (MECHANICS & REPAIRMEN)

- National Apprenticeship and Training Standards for Auto Glass Installation Workers
- Apprentice and Training Standards for Automobile Mechanic, Body Repairman and Painter 0-777-503
- Standards of Apprenticeship - Automobile Mechanics 0-207-65
- Automotive Mechanics Apprentice Standards
- National Trucking Industry Apprenticeship Standards 0-759-791
- Apprenticeship and Training Standards for Truck Mechanics 0-761-425

OTHER TRADES

- National Apprenticeship and Training Standards for the Sign, Pictorial Display, Electric Sign and Process Industry 0-684-483
- National Apprenticeship Standards Photo Engravers

SUGGESTED GUIDES FOR THE SELECTION OF TRAINING CONTENT

Automotive Service Specialist. U. S. Department of Health, Education and Welfare.

M.D.T.A. Suggested Guide for the Selection of Training Content in the Area of Auto Body Repair. Delmar Publishers, Inc., Curriculum Research Division.

M.D.T.A. Suggested Guide for the Selection of Training Content in the Area of Automotive Trades. Delmar Publishers, Inc., Curriculum Research Division.

M.D.T.A. Suggested Guide for the Selection of Training Content in the Area of Machine Shop. Delmar Publishers, Inc., Curriculum Research Division.

M.D.T.A. Suggested Guide for the Selection of Training Content in the Area of Masonry Trades. Delmar Publishers, Inc., Curriculum Research Division.

M.D.T.A. Suggested Guide for the Selection of Training Content in the Area of Practical Nursing. Delmar Publishers, Inc., Curriculum Research Division.

M.D.T.A. Suggested Guide for the Selection of Training Content in the Area of Welding. Delmar Publishers, Inc., Curriculum Research Division.

Machine Technology Series. Delmar Publishers, Inc.

Mechanic, Electronic (Industrial). U. S. Department of Health, Education and Welfare.

Mechanic, Refrigeration, U. S. Department of Health, Education, and Welfare.

Outline of Related Training Program for Plumbing Apprentices, No. TD 200. United Association Training Department for Apprentices and Journeymen, 1959.

Related Subjects Outlines for State Apprentice Training Program. Connecticut State Department of Education, Hartford, Connecticut. April, 1960.

Safety in Industry, Basic Principles of Machinery Safeguarding. U. S. Department of Labor Safety Training Programs, Bulletin 276.

Sheet Metal Worker. U. S. Department of Health, Education, and Welfare.

Vocational Auto Mechanics for Senior High Schools, Series V-4. Utah State Board for Vocational Education, Salt Lake City, Utah.

REFERENCES AND OUTLINES OF RELATED SUBJECTS OF MAJOR APPRENTICEABLE TRADES

The following State Departments of Education have available materials for sale. These manuals can be obtained for a nominal fee by contacting the individual officers.

State of New Jersey (Apprentice Training)
Department of Vocational-Technical Education
Rutgers University, 10 Seminary Place
New Brunswick, New Jersey 08903

Mississippi State University
Curriculum Materials Laboratory
Box 455
State College, Mississippi

Instructional Materials
Bureau of Industrial Education
State Education Building
721 Capital Mall
Sacramento, California 95814

Consultant
Instructional Materials Laboratory
The Ohio State University
1885 Neil Avenue
Columbus, Ohio

Department of Industrial Education
123 Jesse Hall
University of Missouri
Columbia, Missouri

(Student Study Guides & Instructor's Key for Specific occupations each include a trade analysis and what the worker must know and be able to do.)

Instructional Materials
Texas Engineering Extension Service
Texas A & M College System
P. O. Box 236 F.E.
College Station, Texas

Instructional Materials Unit
Vocational Industrial Education Department
P. O. Box 2847
University, Alabama

N.C.A.C. No. 4

APPRENTICESHIP AGREEMENT

THIS AGREEMENT, entered into this __________ day of _________, 19___, between

____, hereinafter referred to as the EMPLOYER, and

____, born ____________, hereinafter referred to as

APPRENTICE (and if a minor) ______________________________, hereinafter referred to as his PARENT (or GUARDIAN).

WITNESSETH, that the EMPLOYER, the APPRENTICE, and his PARENT (or GUARDIAN) desire to enter into an agreement of apprenticeship in conformity with the STANDARDS approved by the NORTH CAROLINA APPRENTICESHIP COUNCIL, and therefore, in consideration of the premises and of the mutual covenants herein contained, do hereby agree as follows:

That the EMPLOYER shall employ and teach the APPRENTICE the trade or craft of

____, in conformity with the terms and conditions contained in the schedule on the reverse side of this Agreement and made a part hereof.

That the APPRENTICE shall diligently and faithfully perform the work of said trade or craft during the period of apprenticeship, in conformity with the terms and conditions set forth on the reverse side of this Agreement and made a part hereof.

That the PARENT (or GUARDIAN) promises that the APPRENTICE will duly perform all obligations undertaken herein.

That the apprenticeship term begins on the _____ day of __________, 19_____, and terminates upon the completion by the APPRENTICE of _______ (years) (hours) of employment for said EMPLOYER in the said trade or craft, as stipulated on the reverse side of this Agreement.

CREDIT FOR PREVIOUS EXPERIENCE AT TRADE _______ APPRENTICESHIP REMAINING __________ YEARS HOURS

CREDIT FOR PREVIOUS RELATED INSTRUCTION _______ HOURS RELATED INSTRUCTION REMAINING _____ HOURS

That this Agreement shall be registered with the NORTH CAROLINA APPRENTICESHIP COUNCIL; after registration the Agreement may be terminated at any time by either party. The State Director of Apprenticeship shall be notified of such termination.

That either party may at any time consult with the registration agency concerning the interpretation of any part of this Agreement over which there is a difference.

IN WITNESS WHEREOF, the parties hereunto set their hands and seals:

______________________________ (SEAL) ______________________________ (SEAL)
(Apprentice) (Employer)

______________________________ By ______________________________ (SEAL)
(Address) (Officer)

______________________________ (SEAL) ______________________________
(Parent or Guardian) (Address)

APPROVED BY ____
(Name of Joint Apprenticeship Committee)

By ______________________________ ______________________________ 19___
(Name) (Title)

APPROVED AND REGISTERED BY THE NORTH CAROLINA APPRENTICESHIP COUNCIL

By ______________________________ On ______________________________

W. Guy Jarrett, Director of
Apprenticeship

SCHEDULE

1. PERIOD OF APPRENTICESHIP
The apprenticeship term is for 8,000 hours of on-the-job training and 144 hours per year of related instruction, when provided by N. C. Division of Vocational Education. The first 500 hours shall be considered a probationary period.

2. SCHEDULE OF WORK PROCESSES SHEET METAL WORKER

A. Benchwork — 1000 hours
1. Care and maintenance of tools and equipment 2. Assembling and hand riveting fabricated parts, soldering and use of fluxes.

B. Operating of Shop Tools and Machines — 1000 hours
1. Straight and rotary shears 2. Rollers and brakes 3. Presses 4. Grinders and drills 5. Groovers and saws 6. Riveters 7. Lockformers

C. Cutting and Forming — 1750 hours
1. Blow pipes 2. Duct work 3. Gutters 4. Ventilators & louvers 5. Dampers

D. Assembling and Erecting — 1750 hours
1. Gutters, downspouts and cornice 2. Ventilators & louvers 3. Ducts and blow pipes 4. Valleys and roofing 5. Dryers & conveyers

E. Welding — 500 hours
1. Electric and spot 2. Acetylene .3. Arc and heliarc

F. Layout — 2000 hours
1. Use of instruments 2. Principles of layout 3. Triangulation 4. Radial Line developments 5. Parallel Line Development 6. Blue prints and templates 7. Sketching.

TOTAL 8000 hours

3. WAGE PROVISIONS:
Journeyman's Wage Normal Work Week 40 hours
Apprentices shall be paid and progressed according to the following pattern of wage increases, based on the wage being paid the journeyman.

First Year: 1st half - 45% of journeyman rate
2nd half - 50% of journeyman rate

Second Year: 1st half - 55% of journeyman rate
2nd half - 60% of journeyman rate

Third Year: 1st half - 65% of journeyman rate
2nd half - 70% of journeyman rate

Fourth Year: 1st half - 75% of journeyman rate
2nd half - 80% of journeyman rate

Applicants with previous experience and training shall be paid the entrance wage in keeping with the credit allowed them.

4. HOURS OF WORK AND OF APPROVED INSTRUCTION:
The apprentice's work day and work week shall be the same as the journeymen and shall be subject to the same overtime requirements, except in cases when the apprentice is under 18 years of age, in which instance the apprentice's work day and work week must conform with the North Carolina Child Labor Regulations. The apprentice shall receive credit for actual hours worked during his term of apprenticeship.

5. SPECIAL PROVISIONS:
The employer certifies that upon satisfactory completion of training the apprentice will be offered employment as a journeyman in his establishment, barring unforeseen circumstances.

FORM 101B

WORK REPORT - BRICKLAYER APPRENTICE

(Name of Apprentice) (Rate of Pay) (Name of Employer)

YEAR	General Labor	Material Handling	Mixing & Tempering Mortar	LAYING TO THE LINE					SPECIALITY WORK				MISCELLANEOUS				Related Instruction
MONTH				Foundation	Walls	Leads & Piers	Chimney & Flues	Pilasters	Fireplaces	Arches	Steps	Special Design	Layout	Blueprints	Using Equipment	Other	
Mon.																	
Tues.																	
Wed.																	
Thur.																	
Fri.																	
Sat.																	
Mon.																	
Tues.																	
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Mon.																	
Tues.																	
Wed.																	
Thur.																	
Fri.																	
Sat.																	
TOTALS																	

Signature of Foreman____________

This report will be used to evaluate your training and to determine eligibility for wage increases. Work should be recorded at the end of each work day and the report sent at the end of each month to the Piedmont Construction Apprentice Council, P. O. Box 1384, Charlotte 1, North Carolina.

FORM 101C

WORK REPORT - CEMENT MASON APPRENTICE

(Name of Apprentice) (Rate of Pay) (Name of Employer)

Year Month	General Labor	Material Handling	Rodding Concrete	Hand Floating	Patching & Rubbing	Setting Screeds	Troweling, Edging and Jointing	Finishing	Pointing	Other	Related Training Class Hours
Mon.											
Tues.											
Wed.											
Thur											
Fri.											
Sat.											
Mon.											
Tues.											
Wed.											
Thur.											
Fri.											
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Fri.											
Sat.											
Mon.											
Tues.											
Wed.											
Thur.											
Fri.											
Sat.											
TOTALS											

Signature of Foreman ______________________

This report will be used to evaluate your training and to determine eligibility for wage increases. Work should be recorded at the end of each work day and the report sent at the end of each month to the Piedmont Construction Apprentice Council, P. O. Box 1384, Charlotte 1, North Carolina.

ATTENDANCE REPORT FOR RELATED INSTRUCTION

Please Observe Carefully:

1. Instructors are to enter all tardies and absences and verify as correct by signature.
2. Students will give the sheet to a designated person, committee member, journeyman foreman, or the extension director of the institution.

Student's Name ____________________

Month ____________ Day ________ Year ________

Report for Month of ____________________

Class Hours No. Title	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	T	A	Instructors Signature
																																Total			

Student's Signature ______________________________ (To be signed after all instructors have been contacted)

TRAINING RECORD

(AUTOMOTIVE MECHANICS)

PRE-APPRENTICE TRAINING

This is to certify that the holder of this certificate has completed the

PRE-APPERNTICE TRAINING COURSE

held at

from to

(Distributor)

APPRENTICE TRAINING

This is to certify that the holder of this certificate has completed the

APPRENTICE TRAINING PROGRAM

held at

from to

(Dealer)

SAMPLE

EMPLOYMENT RECORD

(To Be Filled In By Employer)

DATE	EMPLOYED AS	EMPLOYER
From To		
From To		
From To		
From To		
From To		
From To		
From To		
From To		
From To		
From To		
From To		

DEPARTMENT OF COMMUNITY COLLEGES
VOCATIONAL-TECHNICAL DIVISION

LOCAL ADVISORY CRAFT COMMITTEE
RELATED INSTRUCTION FOR APPRENTICE AND TRADE PROGRAMS

INSTITUTION____

County____________________ City____________________ Date____________

Trade or Occupation____

COMMITTEE MEMBERS:

Representatives
Institutional

Name	Occupation
____________________	____________________
____________________	____________________

Employer Representatives

Name	Occupation
____________________	____________________
____________________	____________________

Employee Representatives

Name	Occupation
____________________	____________________
____________________	____________________

____
Signed - Extension Director or
Local Representative

ADDRESSES
FOR SOME TEXTBOOK COMPANIES
THAT PUBLISH RELATED INSTRUCTION BOOKS
FOR APPRENTICESHIP TRAINING

American Technical Society
848 E. 58th Street
Chicago, Illinois 60637

Delmar Publishers, Inc.
Mountainview Avenue
Albany, New York 12205

E. I. Du Pont De Nemours & Company
Basic Systems Inc.
880 Third Avenue
New York, New York 10022
(Basic Systems Program)

Encyclopedia Britannica Film, Inc.
425 N. Michigan Avenue
Chicago, Illinois 60637
(Temac Programmed Learning Materials)

Ford Motor Company
Dearborn, Michigan
(Programmed Training for Automotive Mechanics and Others)

Goodheart-Willcox
18250 Harwood
Homewood, Illinois

Industrial Training Library
Programmed Instruction Courses
E. I. Du Pont De Nemours & Co. Inc.
Room 7450 Nemours Building
Wilmington, Delaware 19898

McKnight and McKnight Publishing Company
Bloomington, Illinois 61702